JOINT USERS RESOURCE ALLOCATION PLANNING COMMITTEE

Thursday, April 21, 2005, 1:00 p.m.

JPL - Building 303, Room 401

AGENDA

1. **Introductory Remarks ..... G. Burke**
2. **Conflict Resolution ..... G. Burke**
3. **Action Items ..... D. Morris**
4. **SPECIAL REPORTS:**
   - **Voyager Heliopause and Termination Shock Exploration ..... E. Stone**
   - **POLAR's New Tape Recorder Management ..... S. Odendahl**
   - **New Horizon and Messenger Navigation Requirements .....B. Williams**
   - **Ka Band Antenna Calibration ..... M. Wert**
5. **Resource Analysis Team ..... E. Hampton**
   - **Mid-Range Status**
   - **DSN Downtime Forecast**

Jet Propulsion Laboratory
California Institute of Technology

4800 Oak Grove Drive
Pasadena, CA 91109-8099

(818) 354-4321

May 4, 2005

TO: Distribution

FROM: Eugene S. Burke

SUBJECT: April 21, 2005 Minutes of the Joint Users Resource Allocation Planning Meeting

NEXT JURAP MEETING:
Thursday, May 19, 2005
JPL Bldg. 303, Room 401 1:00 p.m.

Attendees:

Abramo, C.	Espinueva, R.	Machado, M.	Satterlee, N.
Andujo, A.	Finnerty, D.	Martinez, G.	Stone, E.
Behrozi, A.	Guduru. S.	Morris, D.	Taylor. T.
Best, R.	Hall, J.	Odendahl, S.	Ward, C.
Buck, D.	Hampton, E.	Poon, P.	Wert, M.
Burke, E.	Hearn, S.	Resnick, M.	Williams, B.
Carder, M.	Kenney, E.	Retana, J.	Yetter, K.
Efron, L.	Lacey, N.	Ross, J.	

The Joint Users Resource Allocation Planning Committee meets monthly to review the status of Flight Projects, the requirements of other resource users, and to identify future requirements and outstanding conflicts. The last regular meeting was held on November 18, 2004 at the Jet Propulsion Laboratory.

Introductory Remarks – G. Burke
Mr. Burke welcomed the attendees to the JURAP meeting and announced that the ACR Task would like to perform a series of tests (12 hour blocks) at DSS-14 during DSS-43 Downtime (after 17 August) to qualify the ACR software in an operational environment prior to installation at DSS-43. In addition, DSS-34 may not return to service due extra time needed for Ka-band calibrations. The DSS-34 DSMS Service Readiness Review meeting is scheduled for today at 3 P.M. Mr. Burke stated that Dr. Edward Stone, past JPL Director will be the special guest speaker.

SPECIAL REPORTS

Voyager Heliopause and Termination Shock Exploration – E. Stone

Dr. Edward Stone, Voyager Project Scientist, California Institute of Technology stated that he and his colleagues have been waiting decades for Voyager 1 to reach the outer limits of the solar system and that this is an exciting time. At the outer limits of our solar system, a solar shock wave is about to overtake NASA's Voyager 1 spacecraft. Dr. Stone also reported the following:

Voyager 1 spacecraft is about to make history again as the first spacecraft to enter the solar system's final frontier, a vast expanse where wind from the Sun blows hot against thin gas between the stars: interstellar space. However, before it reaches this region, Voyager 1 must pass through the termination shock, a violent zone that is the source of beams of high-energy particles

For the past two years or so, Voyager 1 has detected phenomena unlike any encountered before in all its years of exploration. These observations and what they may infer about the approach to the termination shock have been the subject of on-going scientific debates. While some of the scientist believed that the passage past the termination shock had already begun, some of the phenomena observed were not what would have been expected. So the debate continues while even more data are being returned and analyzed. However, it is certain that the spacecraft are in a new regime of space. The observed plasma wave oscillations and increased energetic particle activity may only be the long-awaited precursor to the termination shock. If we have indeed encountered the termination shock, Voyager 1 would be the first spacecraft to enter the solar system's final frontier, a vast expanse where wind from the Sun blows hot against thin gas between the stars: interstellar space.

The Voyager mission continues its quest to push the bounds of space exploration. The twin Voyager 1 and 2 spacecraft opened new vistas in space by greatly expanding our knowledge of Jupiter and Saturn. Voyager 2 then extended the planetary adventure when it flew by Uranus and Neptune, becoming the only spacecraft ever to visit these worlds.

Voyager 1, now the most distant human-made object in the universe, and Voyager 2, close on its heels, continue their ground-breaking journey with their current mission to study the region in space where the Sun's influence ends and the dark recesses of interstellar space begin.

Dr. Stone summarized his presentation with the following:

The long duration of Termination Shock Precursor (TSP) events suggests the source region is no from a transient feature of the shock with short scale length and that the TSP1 and TSP2 source regions are similar. However, TSP3 is different: steeper spectrum, higher intensity at low energy, reduced fluctuations, and little anisotropy.

There was a shock spike on DOY 350 (2004) but the DSN did not collect any data on DOY 351 (2004). Voyager 1 may have crossed the termination shock on or near DOY 351 (2004) and may have transitioned to a unipolar magnetic field region, above the maximum excursion of the neutral sheet and an unusual transient event may have occurred.

Polar's New Tape Recorder Management – S. Odendahl

Mr. Odendahl presented a Polar Mission Status update from Goddard Space Flight Center via the Video Conference Line. He informed the attendees that the Digital Tape Recorder (DTR) Unit #2 failed on December 17, 2004. The Tape recorder management strategy based on two

recorders is now obsolete. Mission success now depends on the FOT's ability to manage the single tape recorder to minimize data losses and single tape recorder capacity is 6-hours and 36-minutes. Mr. Odendahl ended his presentation with the following conclusions: (1) DSN support requirements have not changed with the new plan for single recorder operation; (2) A successful tape recorder management strategy was implemented for operation with a single tape recorder; (3) At Polar's ecliptic normal attitude, aspect angle constraints my impact supports occurring with Polar near the Earth's poles; (4) Polar's orbital precession since launch now favors view periods at the Canberra site.

New Horizon Navigation Overview – B. Williams

Mr. Williams provided and update on the status of the New Horizons mission: The 2006 Baseline includes Launch Date is January 11 through February 14, 2006; Jupiter Flyby is planned to be February through March 2007; and Pluto Arrival is 2015 through 2020.
New Horizon Navigation Summary:

- Radio metric tracking includes issues with transceiver Doppler, transceiver ranging, and Doppler sample rate.
- Navigation team is working together with DSN and APL to resolve all remaining issues.
- Navigation team will participate in remaining end-to-end tests, as well as internal ORTs with JHU/APL Mission Operations, and will be ready for launch on January 11, 2006.
- Navigation team will participate in the Mission Events Readiness Review on December 5, 2005.

MESSENGER Navigation Overview – T. Taylor

Mr. Taylor presented the MESSENGER Navigation status overview: The "Flip" on 8 March 2004 turned sunshade to sun for the lst time. Flyby uncertainties decreased rapidly as we calibrated the new sun-pointing surfaces. "Flop" (sunshade away from sun) in late June 2005 is being considered because of thermal & power issues as spacecraft moves away from sun (will change flyby slightly (~12 km / easily accommodated by Nav).
MESSENGER Navigation Summary:

- Current Navigation prediction is about 3,500 km from Earth flyby aimpoint
  - TCM-5 (23 June) is required & will be 1 – 1.5 m/s
- TCM-5/TCM-6 expected to deliver a 30 km error to aimpoint
  - TCM-7 is regarded as contingency only
- Re-optimization after flyby should result in total mission cost < 1m/s.
  - TCM-8 (flyby cleanup) is unlikely
- Overall: A benign Earth flyby is expected from the Navigation standpoint

Ka Band Antenna Calibration – M. Wert

Mr. Wert reported that Ka-band Model require additional antenna calibrations. To accurately determine model, 4^{th} order of 13 to 16 times the ANTCAL boresight data (118 / 9).
Mr. Wert stated the "Ka-band Challenge":

1. Is to achieve the same results without 13 to 16 times the ANTCAL requirement by: Insisting on boresight data collection automation tool use; Use pre-session observation scheduling optimization software; and use the ITT developing ANTCAL web site (under the direction of Section 923) to monitor the utilization and problems of scheduled ANTCALs.
2. To determine how much ANTCAL time is needed to "get there" by submitting a plan (also

submitted to the mid-range planning beginning in June 2005) to increase Ka-band capable antenna (25, 26, 34, and 55) from 8-hour per 6 weeks to 8-hours per 3 weeks. He noted that we don't have enough experience yet to know what will work the best.

3. The benefit of achieving true Ka-band point calibration will allow Cassini to achieve radio-science goals; MRO to achieve Ka-band telecommunication demonstration goals; Better blind-pointing accuracy for X-band users; and Visibility into pointing error trends (via ANTCAL web site).
4. The work category code of 2A5 will allow flight project with a code of 1A1 to trump ANTCAL when the aperture is tightly scheduled.

RARB Action Items – D. Morris

Mr. Morris reported on the status of the single Action Item from the February RARB.

Action Item: Pending

Externally review the new RFC requirements and implementations to understand impact to users.

Resource Analysis Team – J. Retana

Resource Negotiations Status

The Mid-range Scheduling process has negotiated Mid-Range Schedules through Week 42 (October 23, 2005) - twenty-five (25) weeks ahead of real-time . Currently, there are 9 weeks of conflict-free schedules. Conflict Resolution is required for the following sixteen (16) weeks: 29 through 42.

The next Resource Allocation Review Board Negotiation Process is scheduled for August to review and address contention from July, 2006 through December, 2008. The User Loading Profiles (ULP), Major Events, and Mission Set will be posted on the RAPWEB on 3 May 2005 and the deadline for Projects/Users response will be 20 May 2005

Special studies were completed for the following projects:

SELENE	November 29, 2004
Rosetta	December 13, 2004
DSS-27 Continuation in Service	January 5, 2005
TDRSS Request for DSS-46	February 3, 2005
MRO Study	February 22, 2005
DSN Downtime Proposals	March 7, 2005
Hayabusa (MUSES-C)	March 14, 2005
26 Meter Subnet Impact	March 14, 2005

Action Item Status From 8 February 2005 RARB

(Resource Allocation Review Board)

David G. Morris

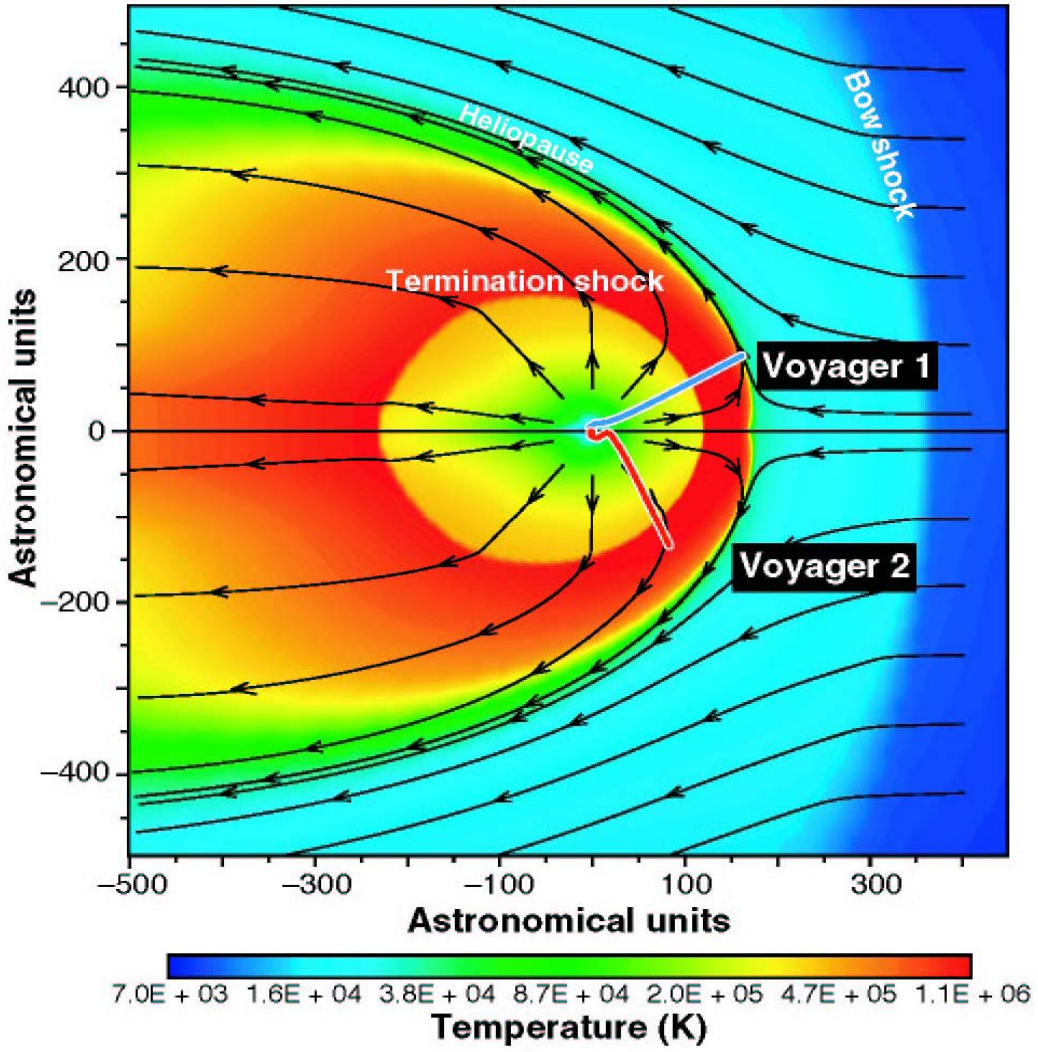
Action Item Summary

AI#	*Year*	*Month(s)*	*System*	*Responsible*	*Due Date*	*Status*
01	2006 - 08	All	RFC	B. Geldzahler	TBD	Pending

ACTION: Externally review the new RFC requirements and implementations to understand impact to users.

RESPONSE: (2/18/2005) B. Geldzahler suggested that "… this item is closed. First of all NRAO asked for too much money to go forward. Second. We don't need the Ka-band catalog. I spoke with Jim Border and Steve Lichten about this. We can use DDOR at X-band to get us close and the use Steve Synnott's optical autonomous Nav camera to do the rest. We need this anyway because ODF light travel time limitations. So the upshot is that we save money by not going forward with NRAO and the new Nav technique to be demoed on Mars '09 then takes over."

(3/7/2005) C. Jacobs reported to R. Miller that he is working with S. Lichten to clarify the justification for the need and rationale for Ka-band reference frames for VLBI, aiding in delta DOR for navigation, and blind pointing.

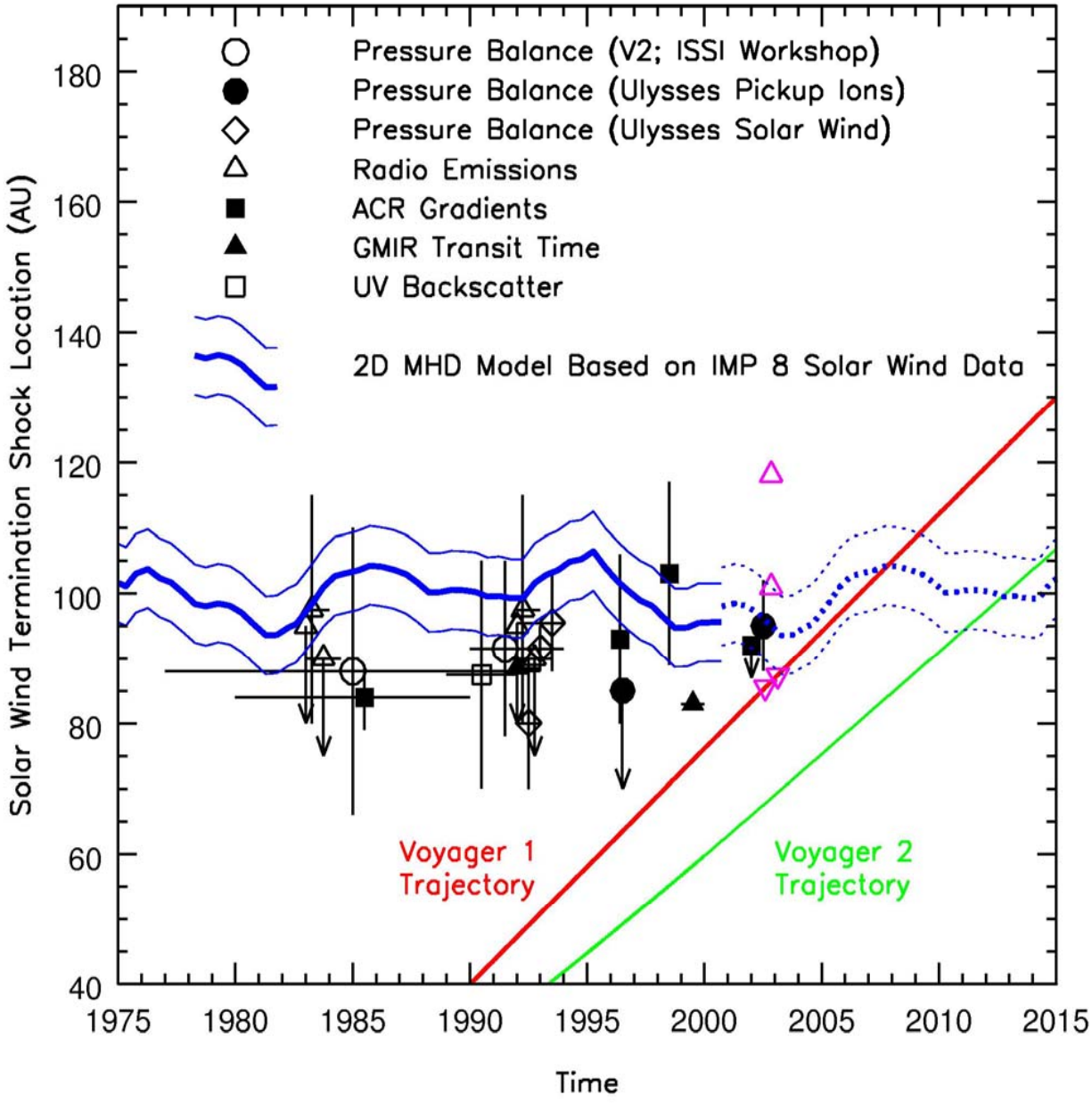


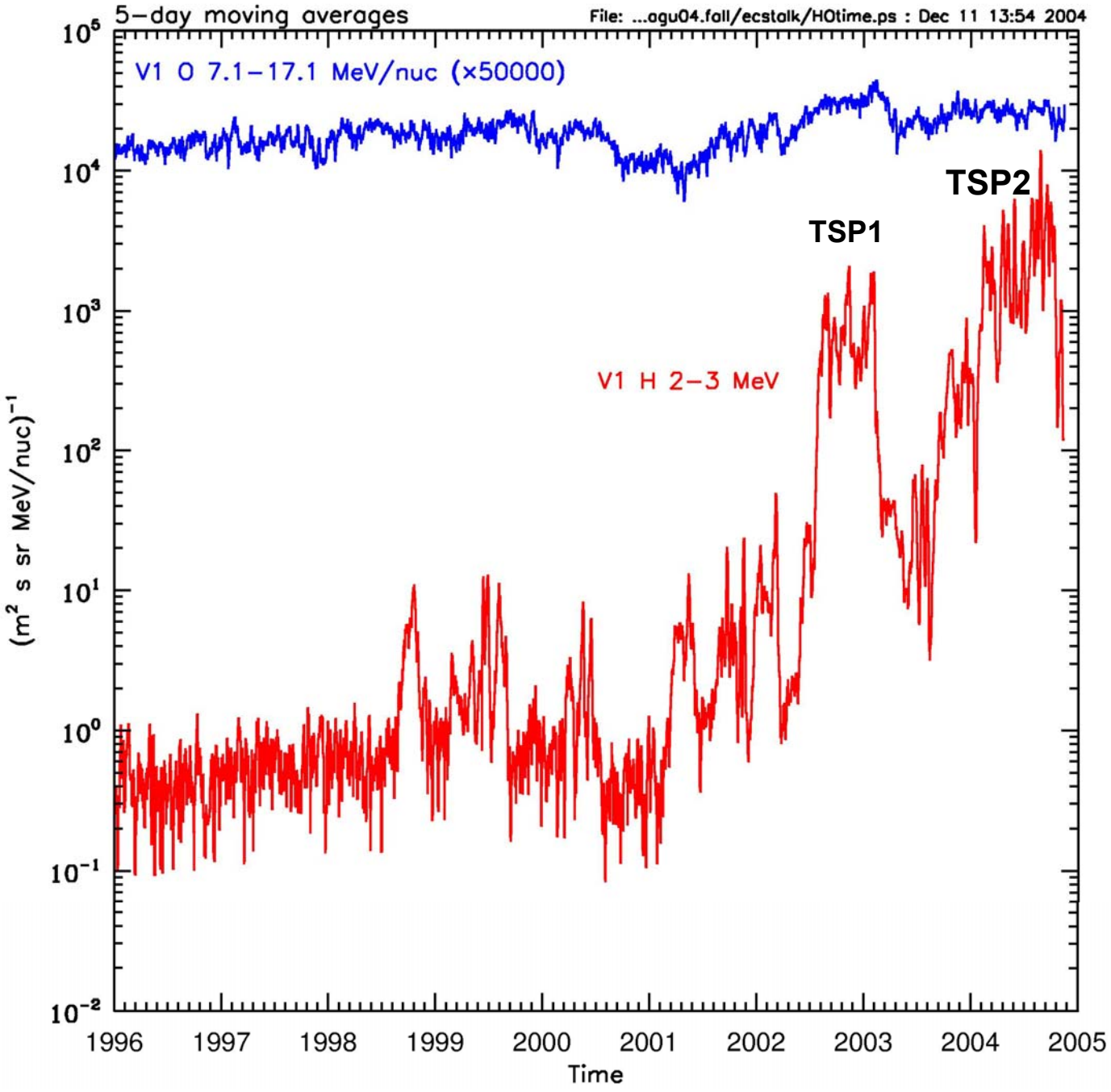
VOYAGER 1 AT THE TERMINATION SHOCK

E. C. STONE

JURAP

4/21/05


Pressure Balance (V2; ISSI Workshop)
Pressure Balance (Ulysses Pickup Ions)
Pressure Balance (Ulysses Solar Wind)
Radio Emissions
ACR Gradients
GMIR Transit Time
UV Backscatter
2D MHD Model Based on IMP 8 Solar Wind Data
Voyager 1 Trajectory
Voyager 2 Trajectory
Solar Wind Termination Shock Location (AU)
Time
180
160
140
120
100
80
60
40
1975
1980
1985
1990
1995
2000
2005
2010
2015

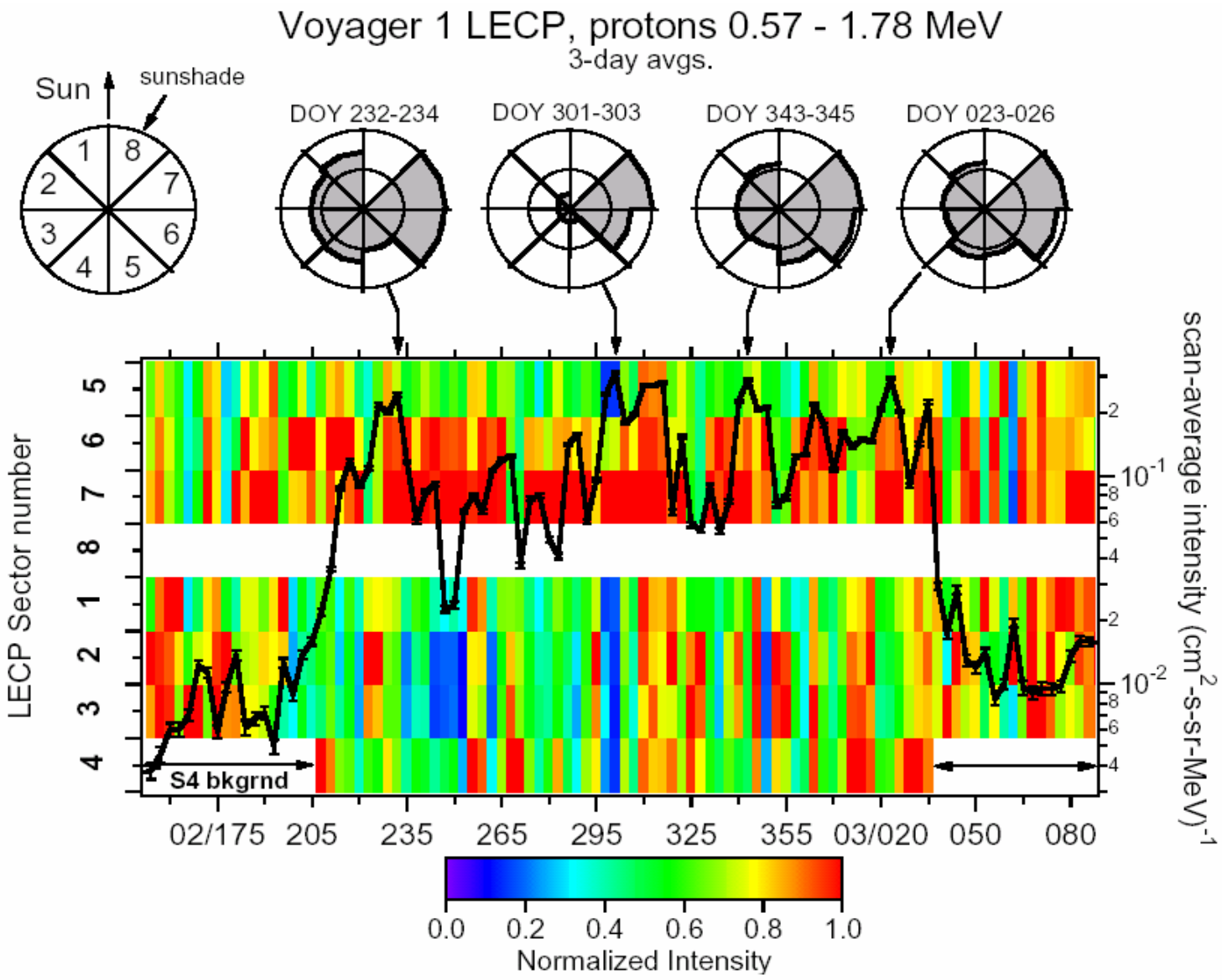


ACR oxygen (5.4-17.1 MeV/nuc) intensities at VGR1

Two TSP episodes of enhanced intensity of 2-3 MeV hydrogen at VGR1

Note TSP intensity has much greater daily variation

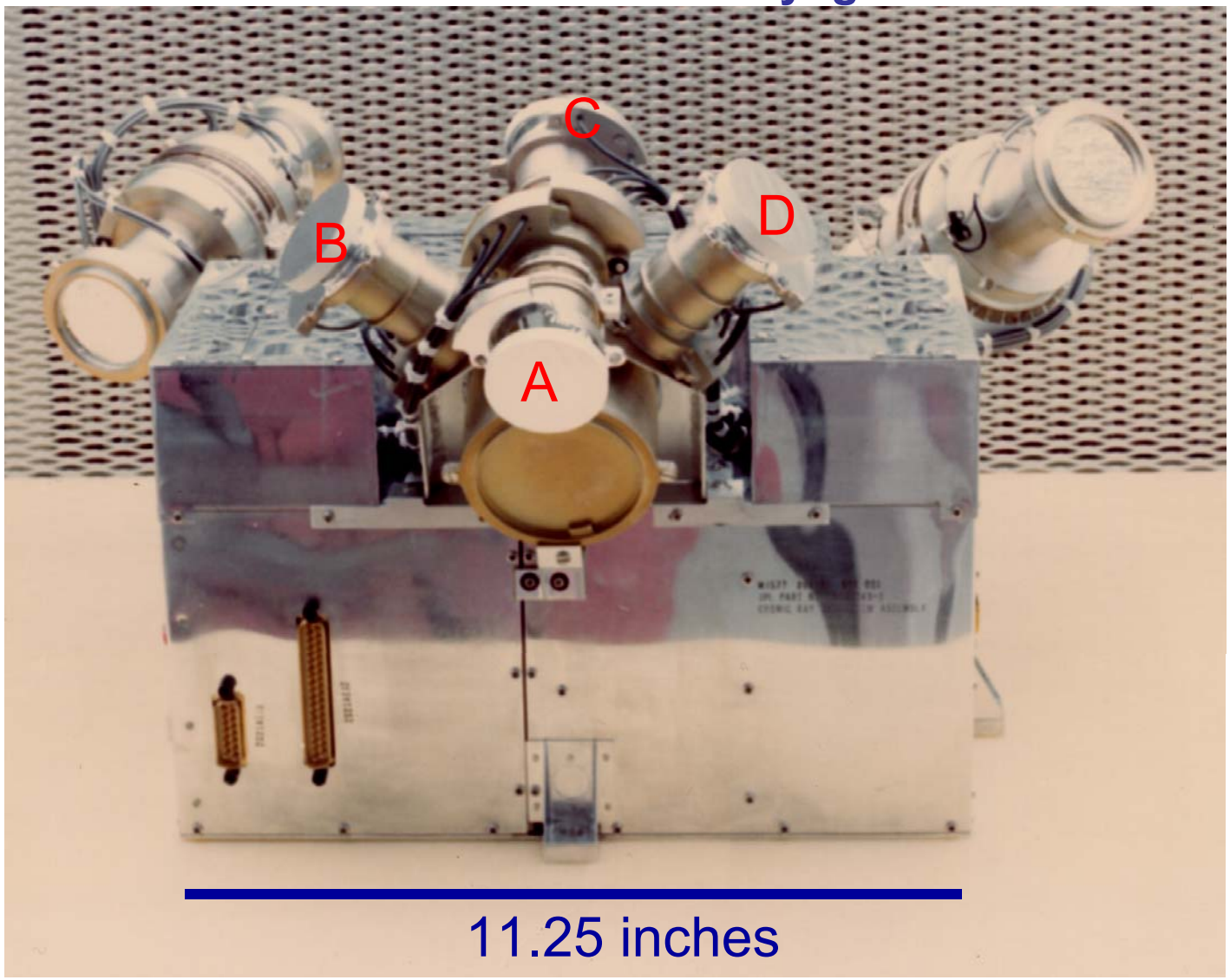
TSPs during much of last 2½ years indicates that source is durable feature



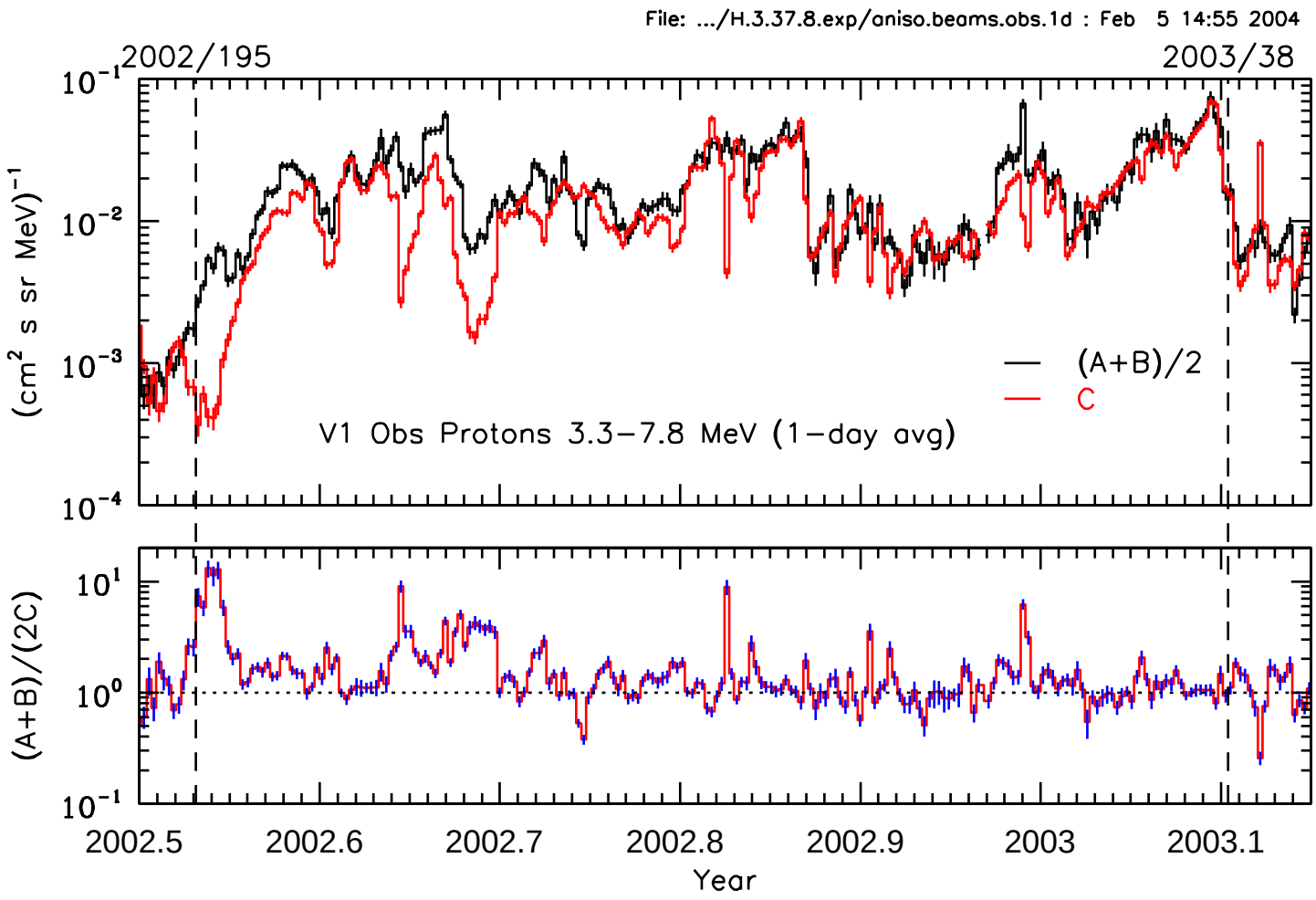
$\delta_{CG} = 2(\gamma + 1)\, V_{SW}/\, v \;= 0.14$ at 1 MeV

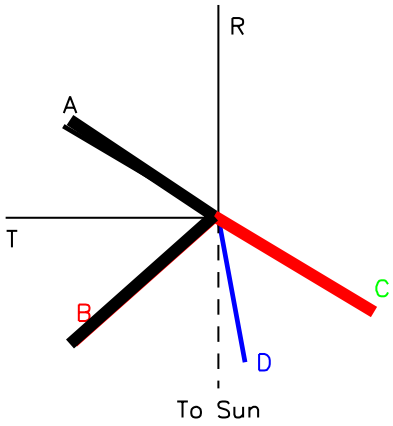
Krimigis et al. 2003

CRS instrument on Voyager 1



3.3-7.8 MeV protons during TSP1 2002-2003

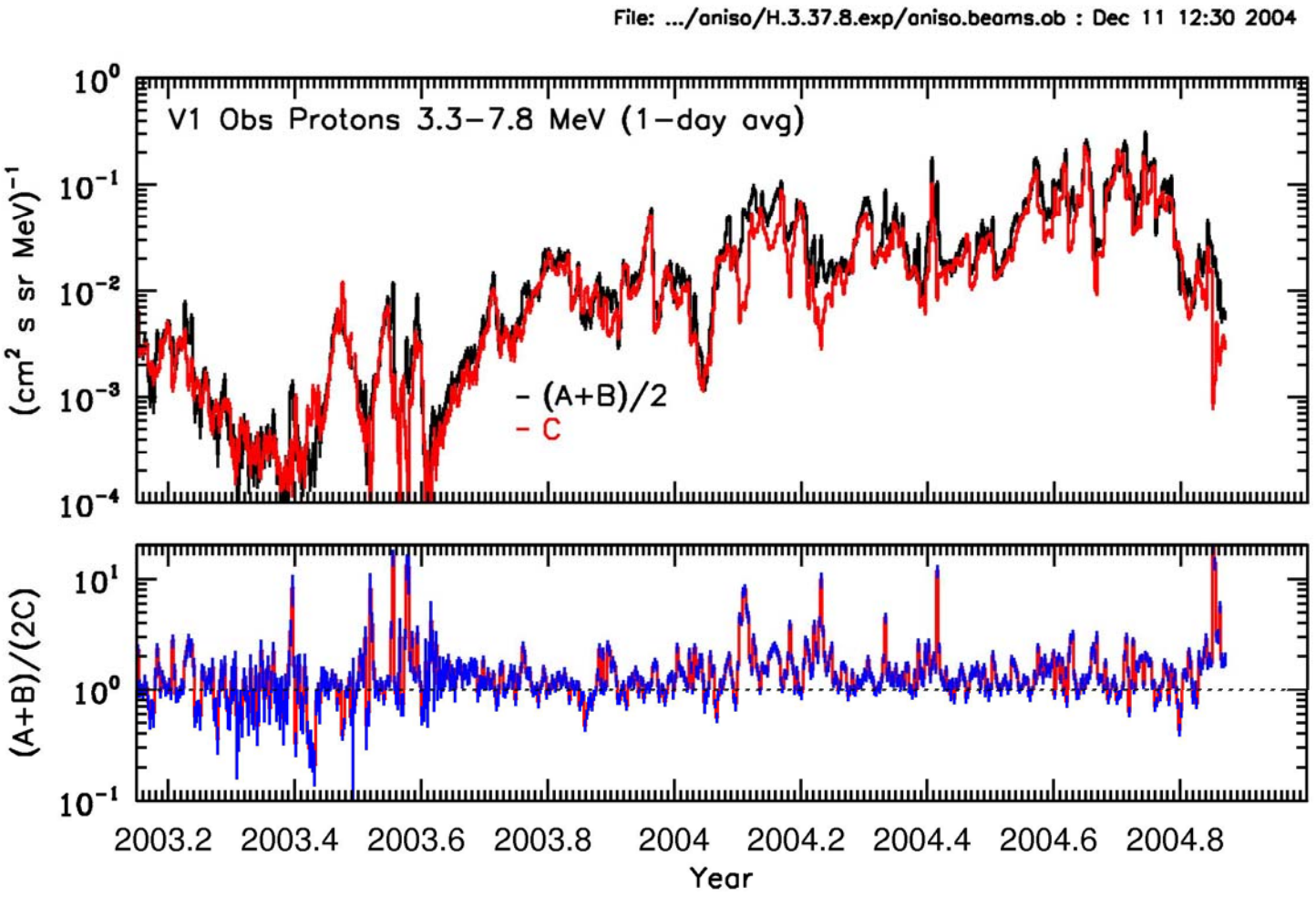




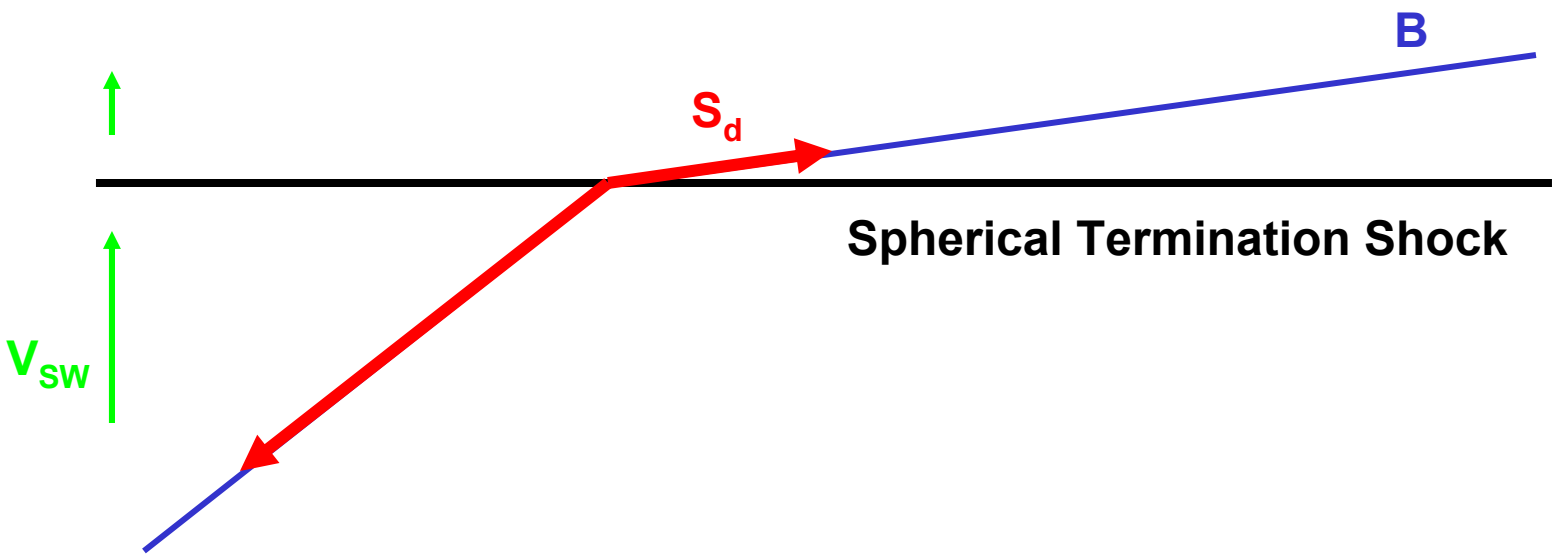
Beams present ~70% of the time, mainly in –T direction

Time scales often ≤ 1 day

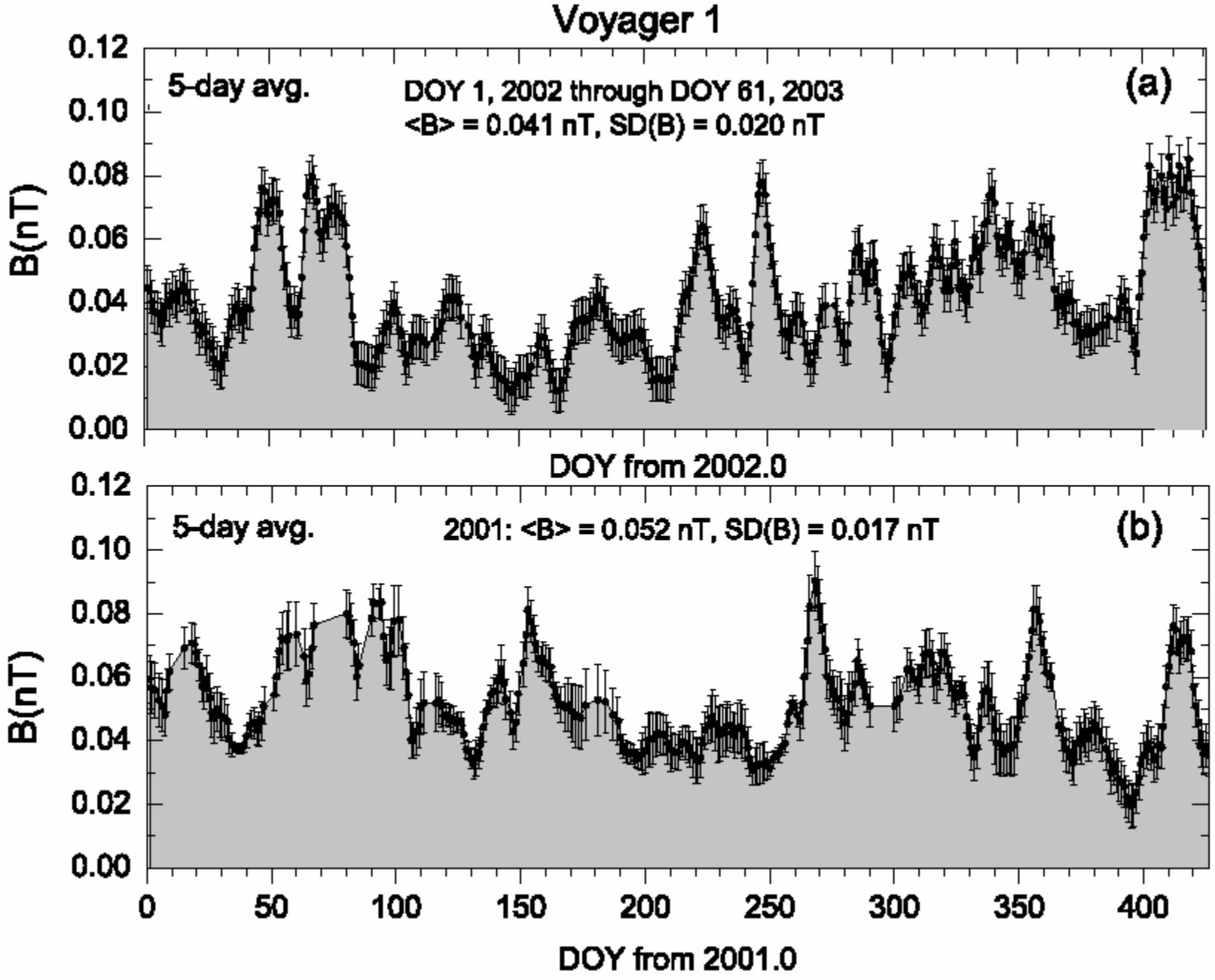
Beaming during TSP2 is similar to TSP1



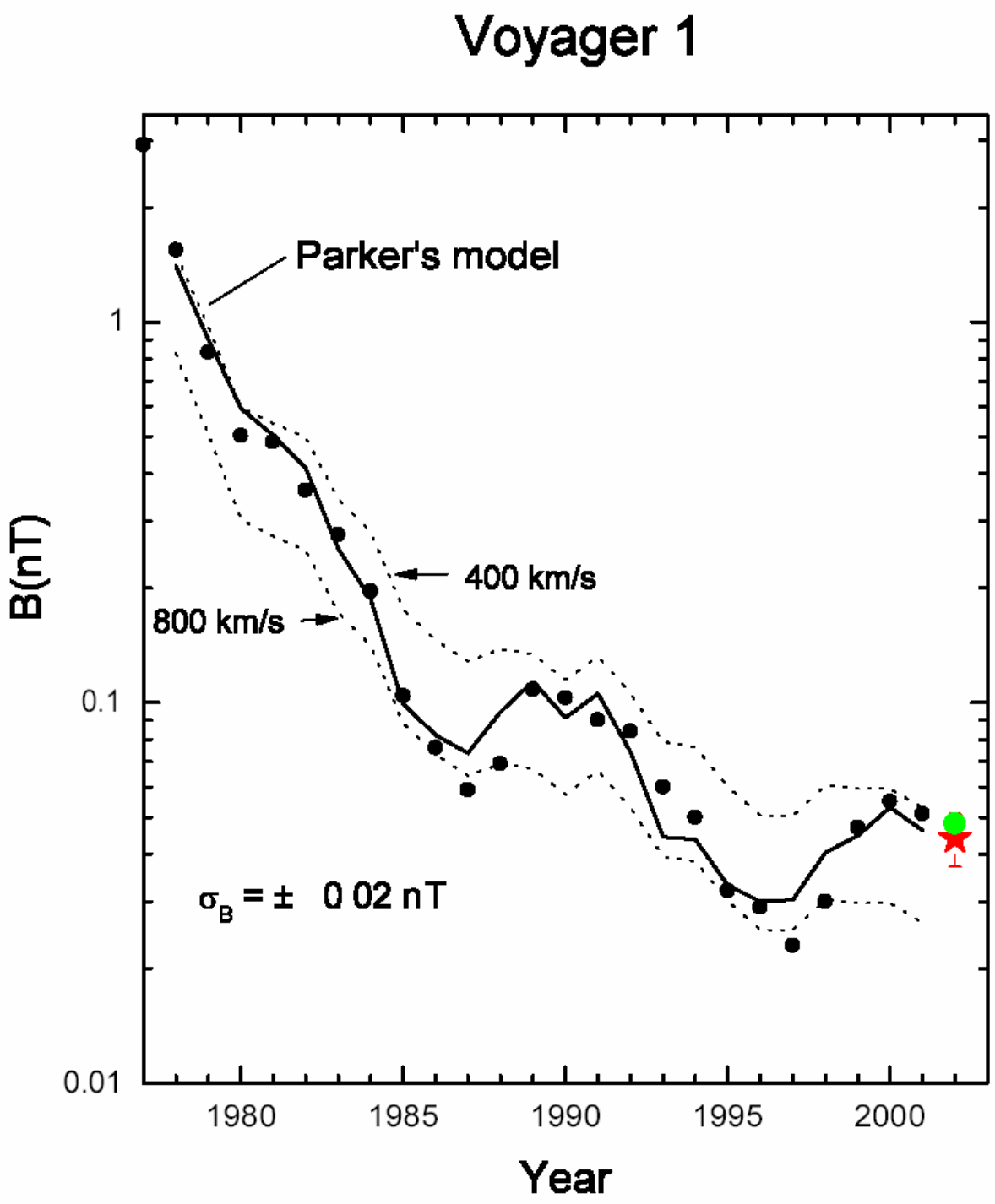
TSP Source Topology



Note the radial component of B is highly exaggerated for illustration



Burlaga et al. 2003



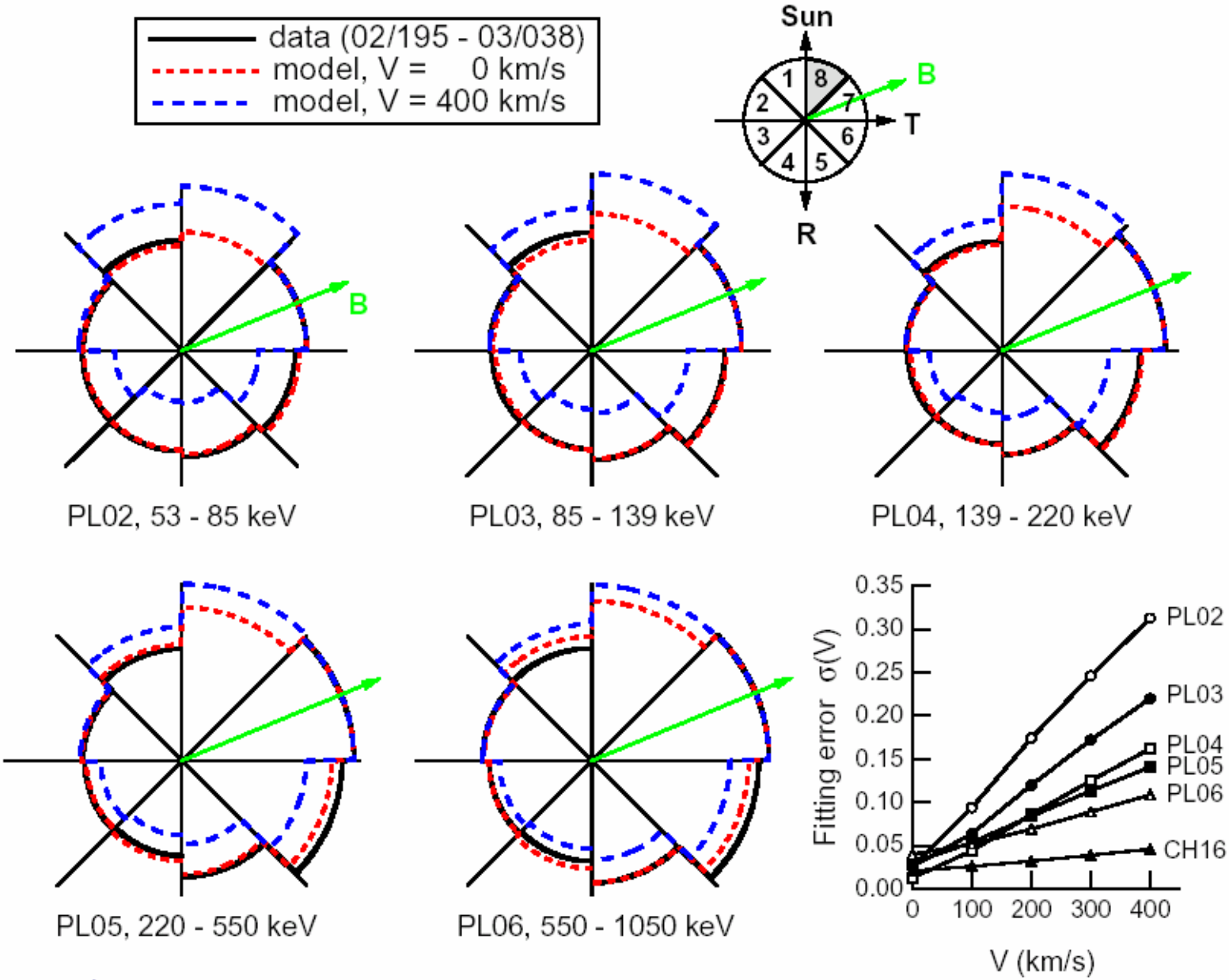
Predicted Parker field in 2002:

0.047±0.003 nT

Observed average field:

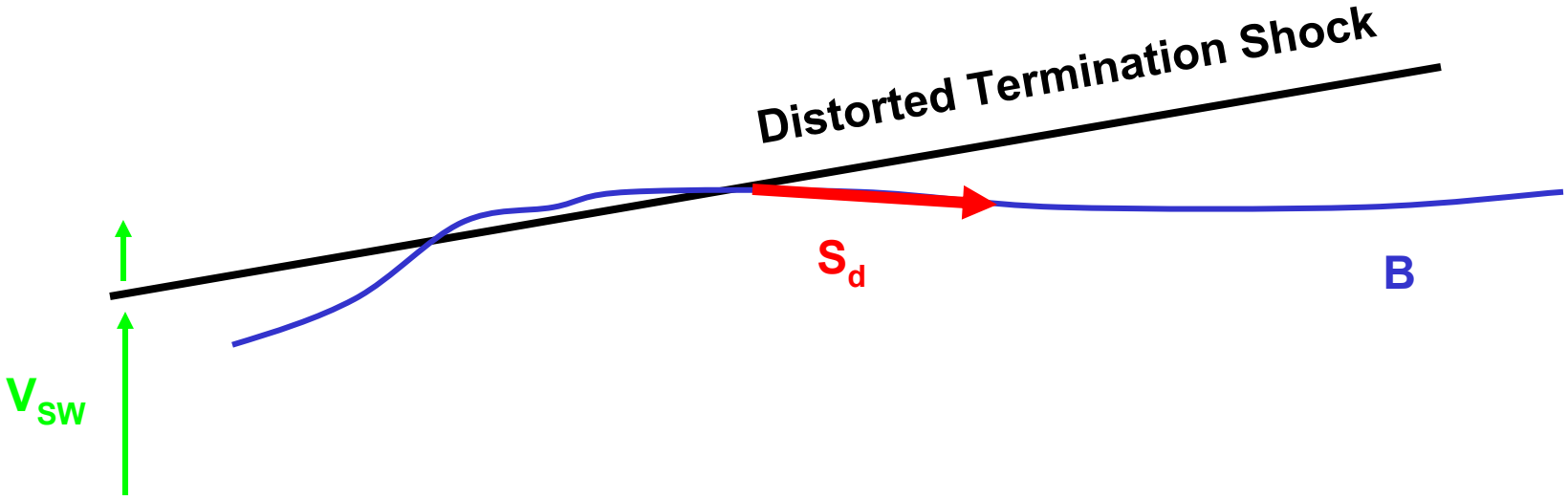
0.041 nT

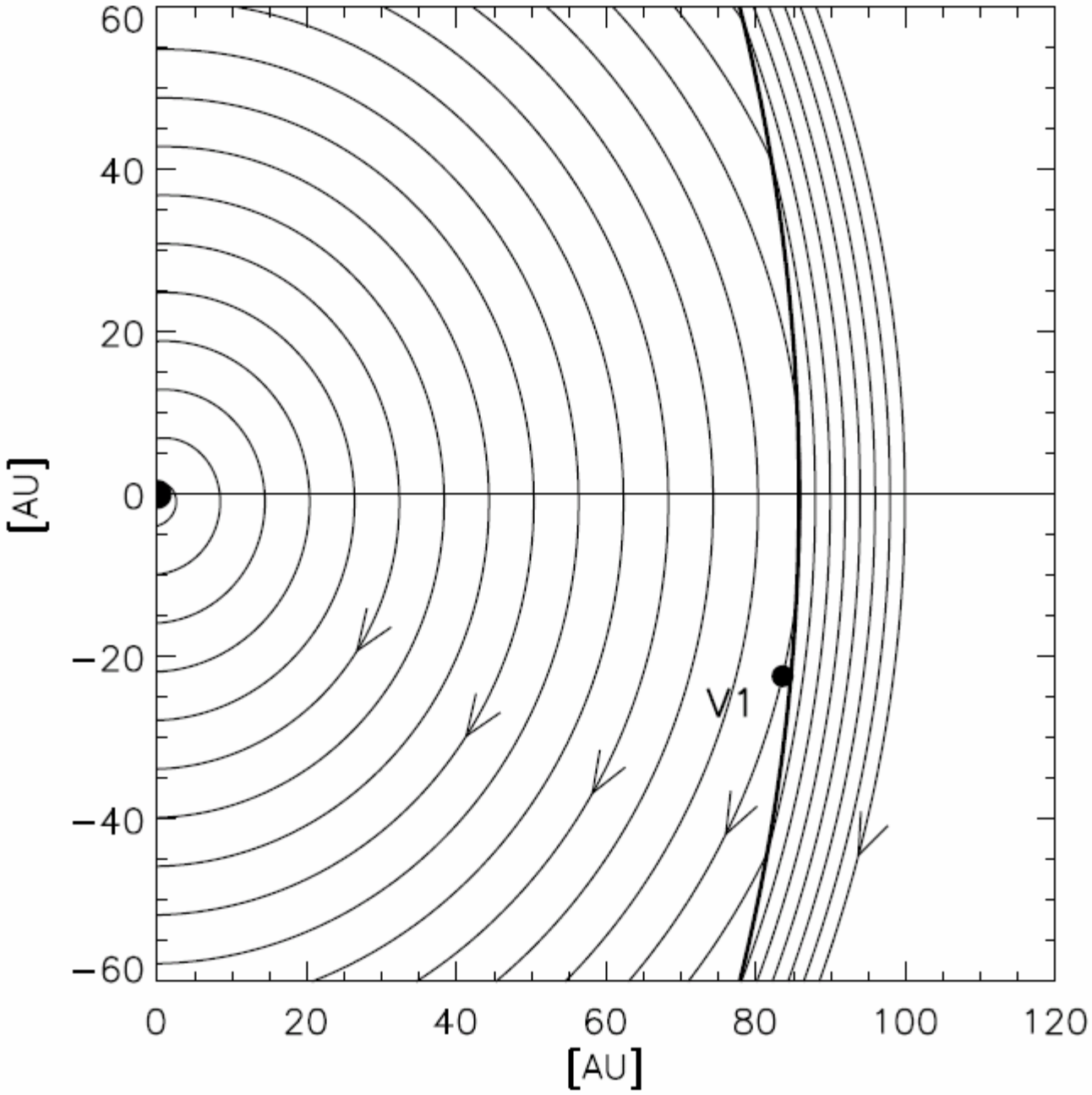
Burlaga et al. 2003



δ_r ~ 0 for all energies **V<50 km/s** **Krimigis et al. 2003**

Zhang suggests that with a larger background correction the distribution can be fit with a supersonic wind if B is azimuthal (COSPAR 2004)


Distorted Termination Shock
S_d
B
V_{SW}



Note that the flattening and the shock motion must be such that this geometry persists for most of the last 2½ years as Voyager moved from 85 to >93 AU

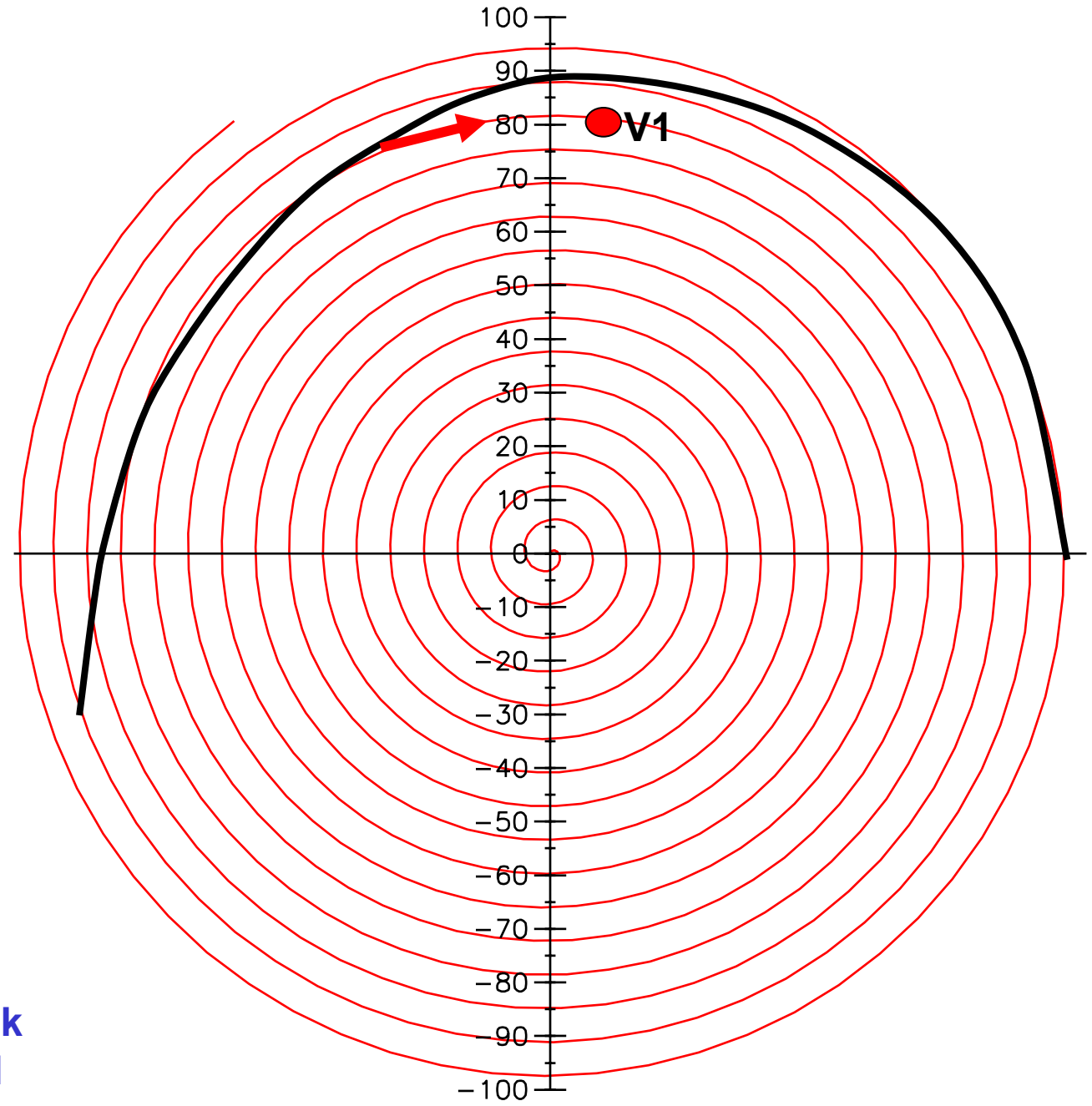
Jokipii, Giacalone, and Kóta 2004

File: ...agu03.fall/TSmotion/archimedplot.p : Dec 5 16:31 2003

Asymmetric termination shock may be source of low energy TSP component

Source of modulated ACRs from shock regions not connected to Voyager 1

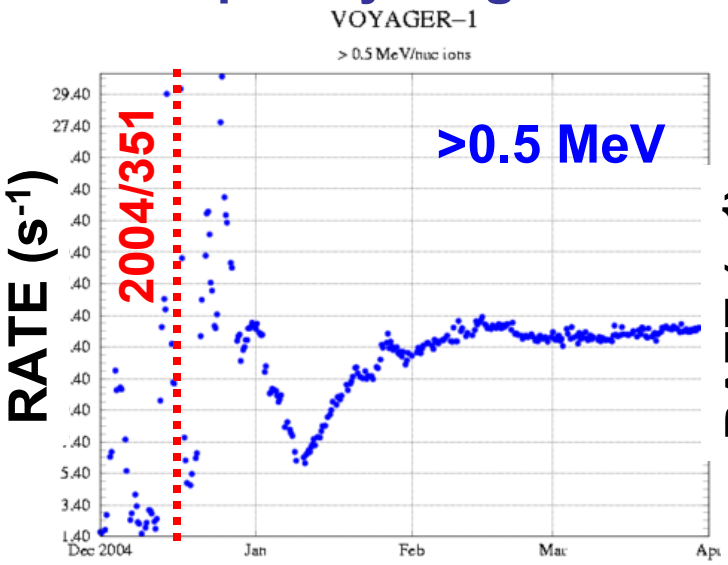
Is the direction of B_{ISM} and distortion large enough?

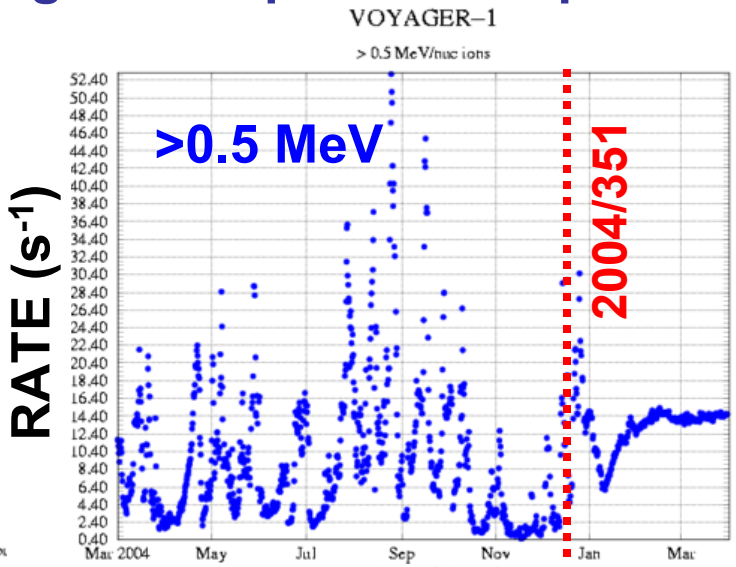


Field beyond shock will be compessed

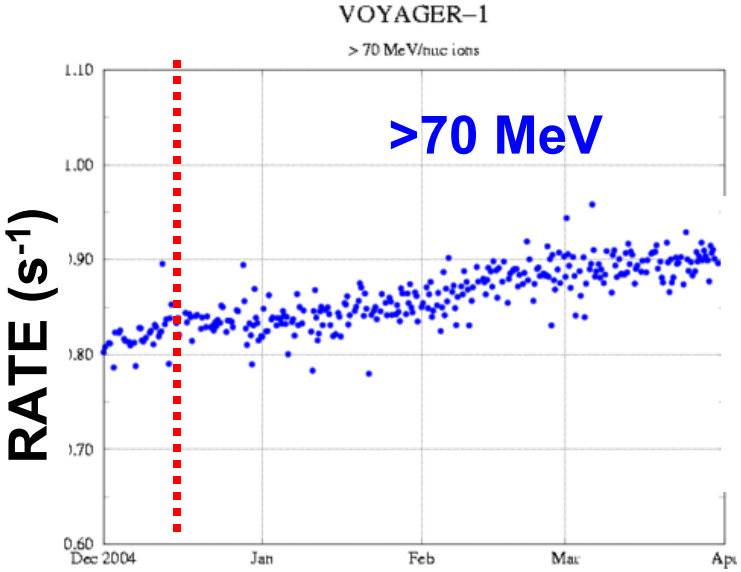
Voyager 1 CRS Browse Plots

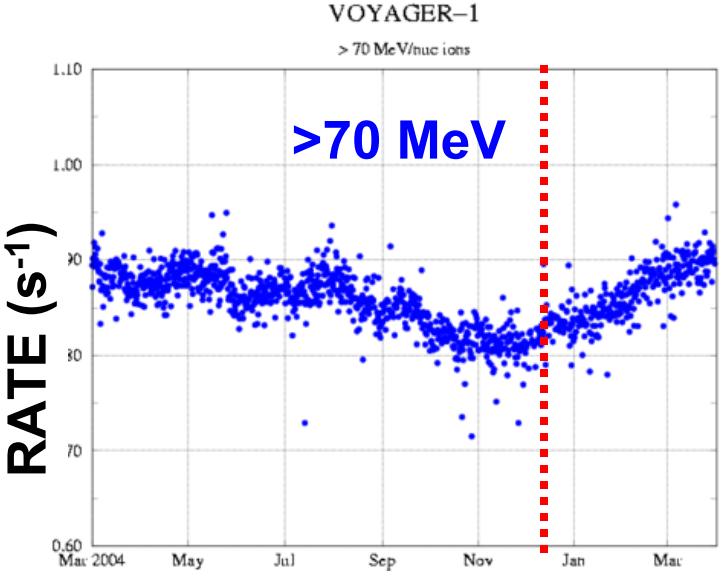
http://voycrs.gsfc.nasa.gov/heliopause/heliopause/data.html





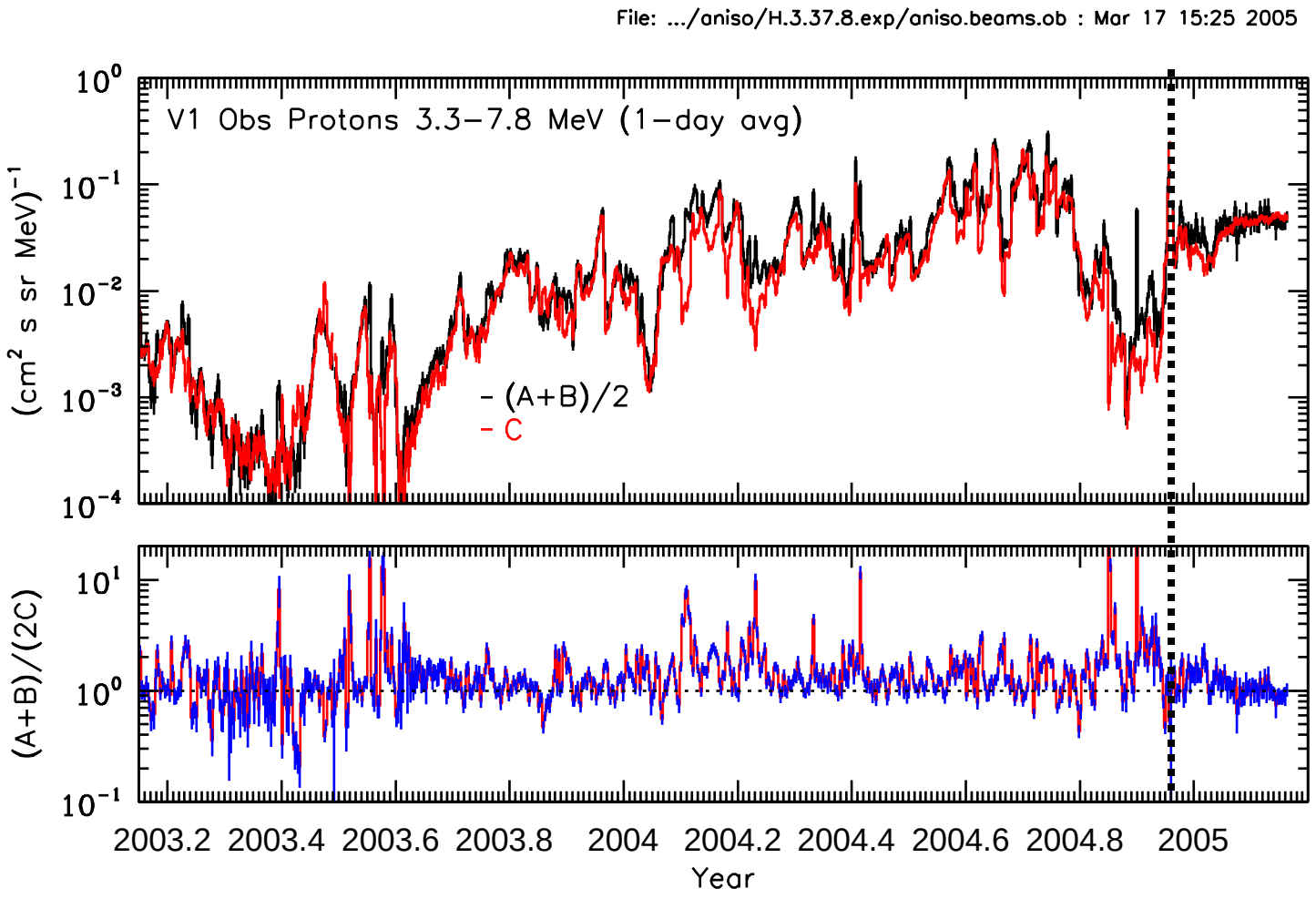
Variability in intensity much reduced after late December 2004

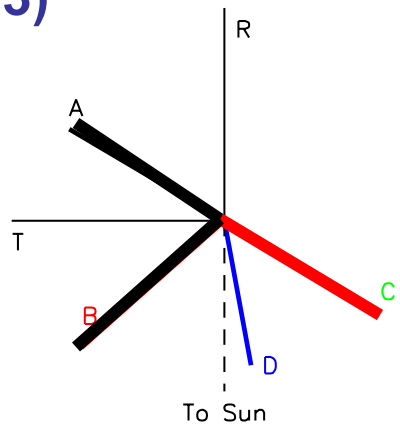




If event of 2004/351 did not result in Forbush type decrease of galactic cosmic rays, then not a transient -> maybe V1 crossed the shock

3.3-7.8 MeV protons during 2003-2004 (TSP2 & TSP3)





Enhanced fluxes of particles returned after the first event.

Beaming is similar in TSP2 to what was observed in TSP1.
Not much beaming in TSP3.

Summary

- Long duration of TSP events suggests the source region is not from a transient feature of the shock with short scale length
- TSP1 and TSP2 source regions are similar
- TSP3 is different
  - Steeper spectrum
  - Higher intensity at low energy
  - Reduced fluctuations
  - Little anisotropy
- Shock spike on 2004/350
- Possibilities:
  - V1 may have crossed the termination shock near 2004/351
  - V1 may have transitioned to a unipolar magnetic field region, above the maximum excursion of the neutral sheet
  - Unusual transient event may have occurred

Concluding Comments

- Voyager continues to reveal new aspects of acceleration by the largest scale shock that is accessible
- The shock region and acceleration process are more complex than commonly expected
- Observations suggest that acceleration varies in different regions of the shock
- For the last year the dynamic pressure has been declining and the heliosphere contracting, so it is increasingly likely Voyager will encounter the shock in the near future
- Radial motion of the shock due to transients and to pressure changes with the solar cycle should result in several shock encounters under different interplanetary conditions
- The first in situ observations of the heliosheath will likely reveal unexpected properties of this unexplored region

Polar Mission Status and New Tape Recorder Management Strategy

Presented by Steve Odendahl, NASA Goddard Space Flight Center

April 21, 2005 JURAP

Material prepared at NASA/GSFC
by
Heather Franz, Wind Flight Dynamics Analyst
Dr. Neil Ottenstein, Polar Flight Dynamics Analyst
Joyce Milasuk-Ross, Wind/Polar Mission Scheduler/Planner
Steve Hearn, Wind/Polar Spacecraft Engineer
John Wainwright, Wind/Polar Instrument Engineer
Dr. Nicola Fox, Polar Science Operations Coordinator

Scope of Presentation

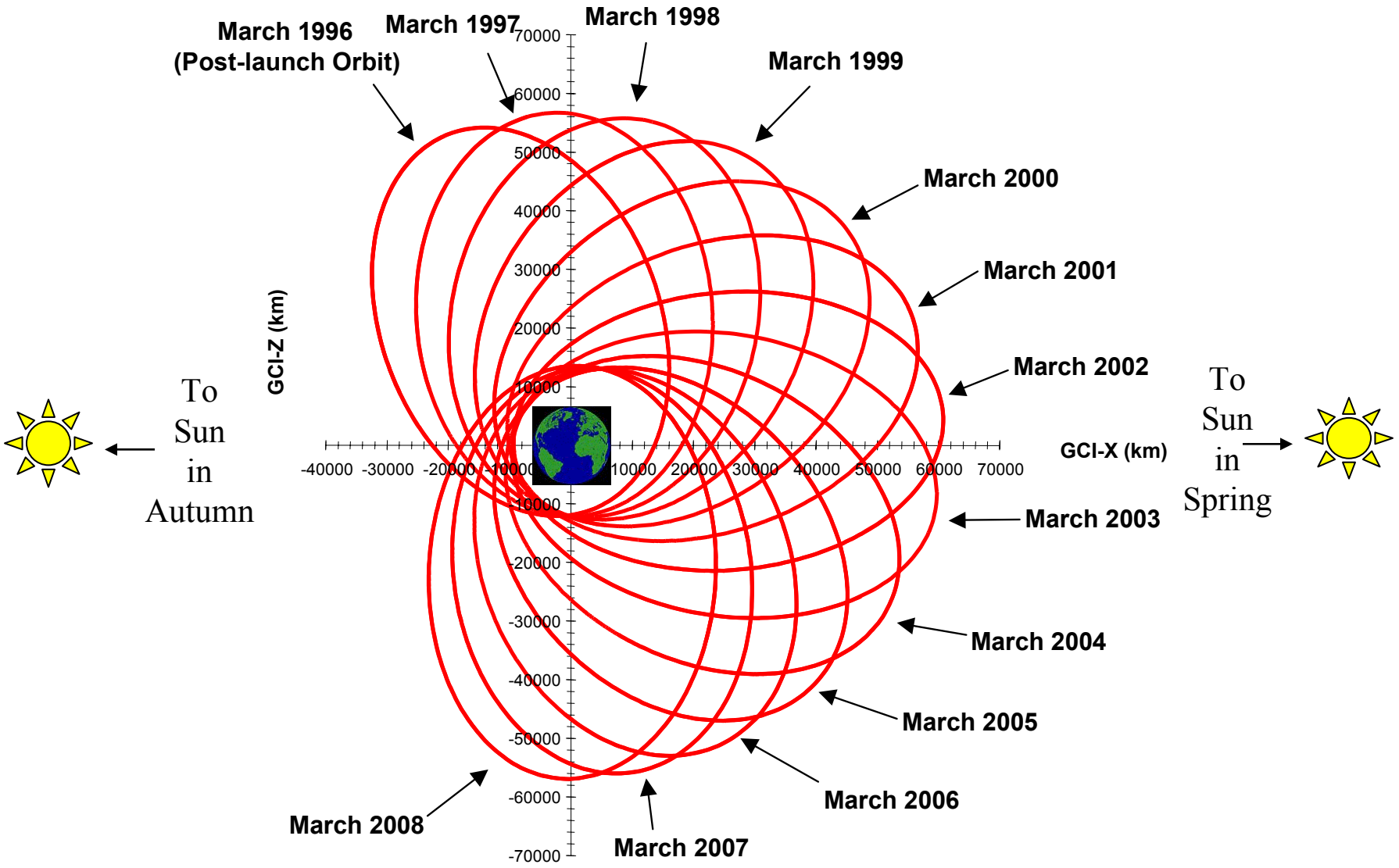
- Current Polar Mission Status
- Science Objectives
- Tape Recorder Management
- DSN Requirements

Polar Mission Status

- Polar is now in the extended mission, ecliptic-normal attitude
- Final semi-annual attitude reorientation ("flip") maneuver executed on September 1, 2003
- Insufficient fuel remains for future flip maneuvers
- Small attitude adjustments are being made periodically to maintain a greater than 90 deg. sun angle
- Apogee is now in the southern hemisphere
  - Apogee latitude of 44.52 deg. South as of April 15, 2005
  - Canberra stations are prime supporting sites

Precession of Polar's Orbit Plane

(Earth-centered Mean-of-J2000 Earth Equator Coordinates)



Orbit apsidal precession rate is approximately 16° per year

Polar Science Objectives 2005-2006

- Polar, in conjunction with Cluster and Double-Star
  - Resolve spatial-temporal ambiguities in the cusp region
- Collaboration with FAST and THEMIS ground-based component
  - Polar will make high-altitude measurements of the auroral acceleration region
  - Ground stations will observe ionospheric currents and auroral structures
- Long-term Radiation Belts Investigations
  - Polar's orbit ideally situated to traverse all zones of the radiation belts
- Joint studies with Cluster in the northern hemisphere and Polar in the southern hemisphere (Spring 2005 & 2006)
  - Investigate the global consequences of magnetic reconnection

Polar Tape Recorder Management

- Digital Tape Recorder (DTR) Unit #2 failed on December 17, 2004
- Tape recorder management strategy based on two recorders is now obsolete
- Mission success depends on the FOT's ability to manage the single tape recorder to minimize data losses
- Single tape recorder capacity is 6-hours and 36-minutes

Polar Tape Recorder Management (cont'd)

- Longer support durations may be required to minimize data loss
- Real-time data are used to supplement playback data
  - Data gaps are minimized
- When data gaps cannot be eliminated by the scheduling process, record intervals are arranged to ensure coverage of science objectives

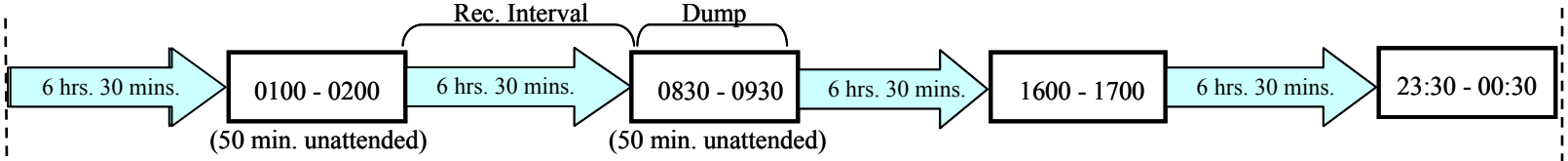
POLAR 24-hour DAY

Digital Tape Recorder Management & DSN Supports

(Single Tape Recorder Operations)

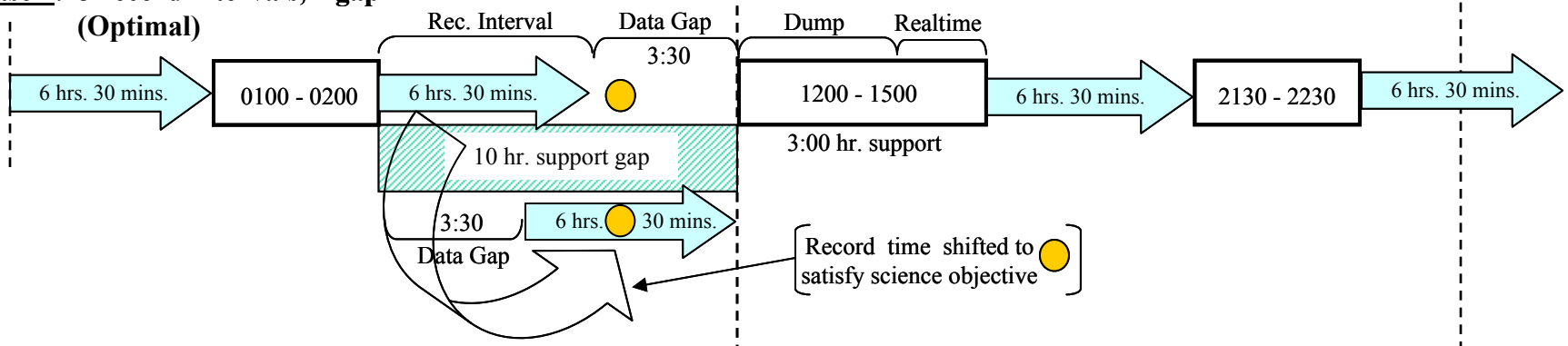
Ideal Record Cycle - No Data Gaps

A. 4 record intervals , 0 gaps



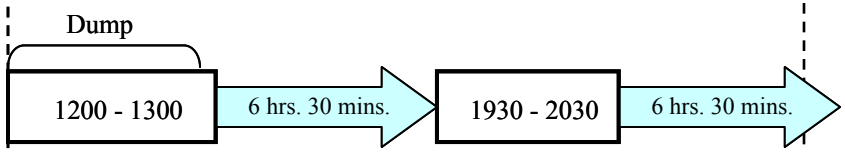
Record Cycle with Data Gap

B. Case 1: 3 record intervals, 1 gap (Optimal)

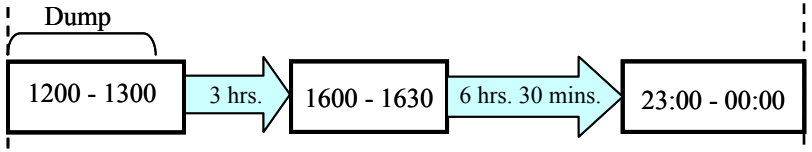


Options

Case 2: 3 record intervals, 1 gap (Acceptable)



Case 3: 4 record intervals, 1 gap (Inefficient)



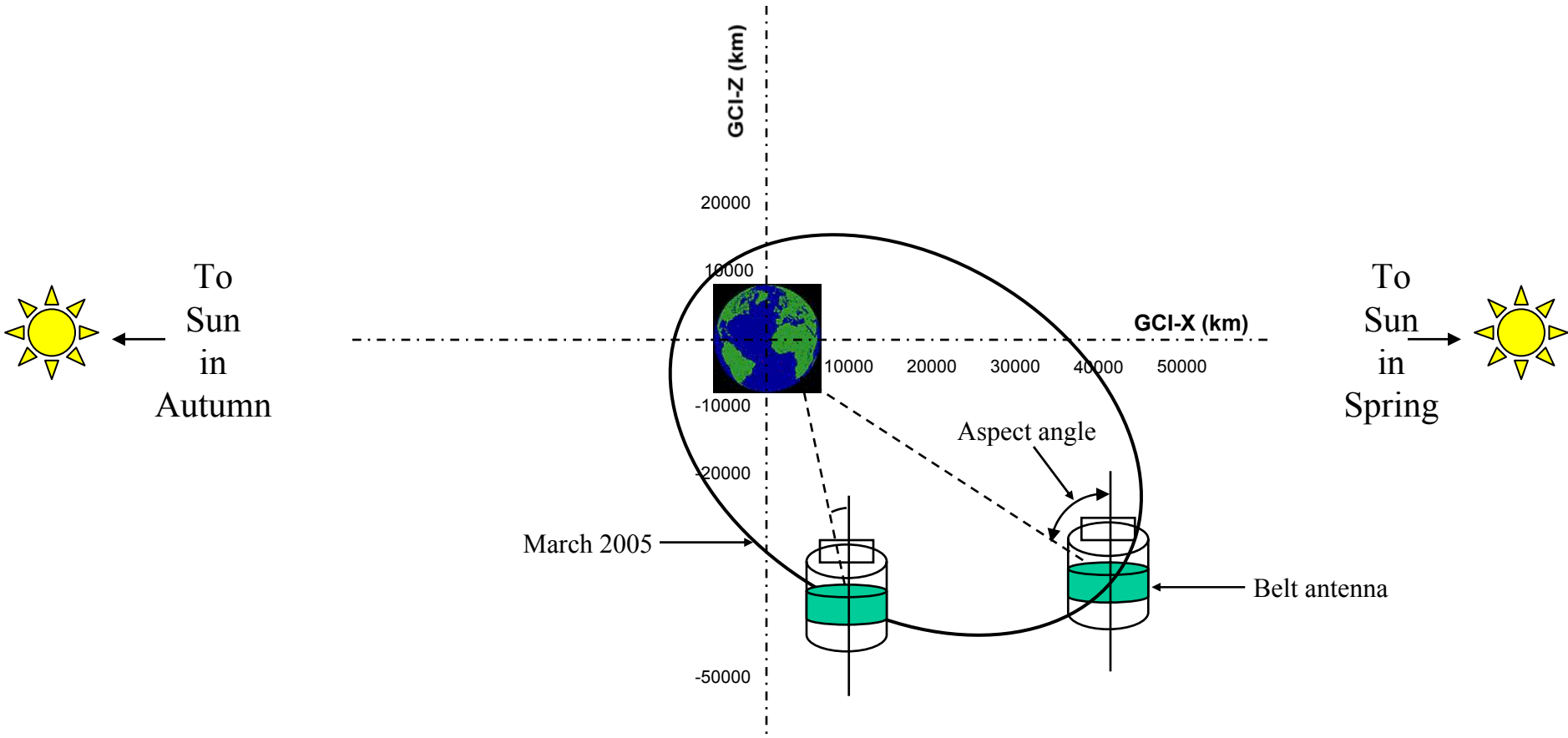
(Not drawn to scale)

Polar DSN Requirements

- DSN support requirements have not changed
- ULP: Four one-hour supports for each 24-hour day
  - Shortened support duration (50 min.) for unattended operations
  - Extended supports used to close data gaps
- Apogee is now in the southern hemisphere
  - Apogee latitude of 44.52 deg. South on April 15, 2005
  - Canberra stations are prime supporting sites
- Aspect angle problems may occur (at angles less than 30 deg. and greater than 150 deg.) when spacecraft passes near the Earth's poles

Antenna Aspect Angle

Polar's Orbit Plane - March 2005



Polar Nominal DSN Supports

DSN Pass Activity	***Action***
PB ONLY (single playback)	50 minutes. Unattended Ops Only (1 hour for day shift*)
PB OPS (single playback and realtime)	Greater than 1 hour

* Day shift is defined as 7 a.m. to 7 p.m. ET

DSN Sites Supporting Polar

(Ranked in order of requirement and preferred usage)

Nominal Supporting Stations		
DSN Site:	26-meter:	Service:
Goldstone	**DSS-16**	**Ranging, Uplink, Downlink**
Madrid	**DSS-66**	" " "
Canberra	**DSS-46**	" " "
Alternate Supporting Stations		
DSN Site:	BWG1:	Service:
Goldstone	**DSS-24**	**Ranging, Uplink, Downlink**
Madrid	**DSS-54**	" " "
Canberra	**DSS-34**	" " "
	HSB:	
Goldstone	DSS-27	No-Ranging, Uplink, Downlink
	HEF:	
Goldstone	DSS-15	No-Ranging, Downlink Only
Madrid	DSS-65	" "
Canberra	DSS-45	" "

Conclusions

- DSN support requirements have not changed with the new plan for single recorder operation
- A successful tape recorder management strategy was implemented for operation with a single tape recorder
- At Polar's ecliptic normal attitude, aspect angle constraints may impact supports occurring with Polar near the Earth's poles
- Polar's orbital precession since launch now favors view periods at the Canberra site

New Horizons
Mission to Pluto/Charon

Project Navigation Overview

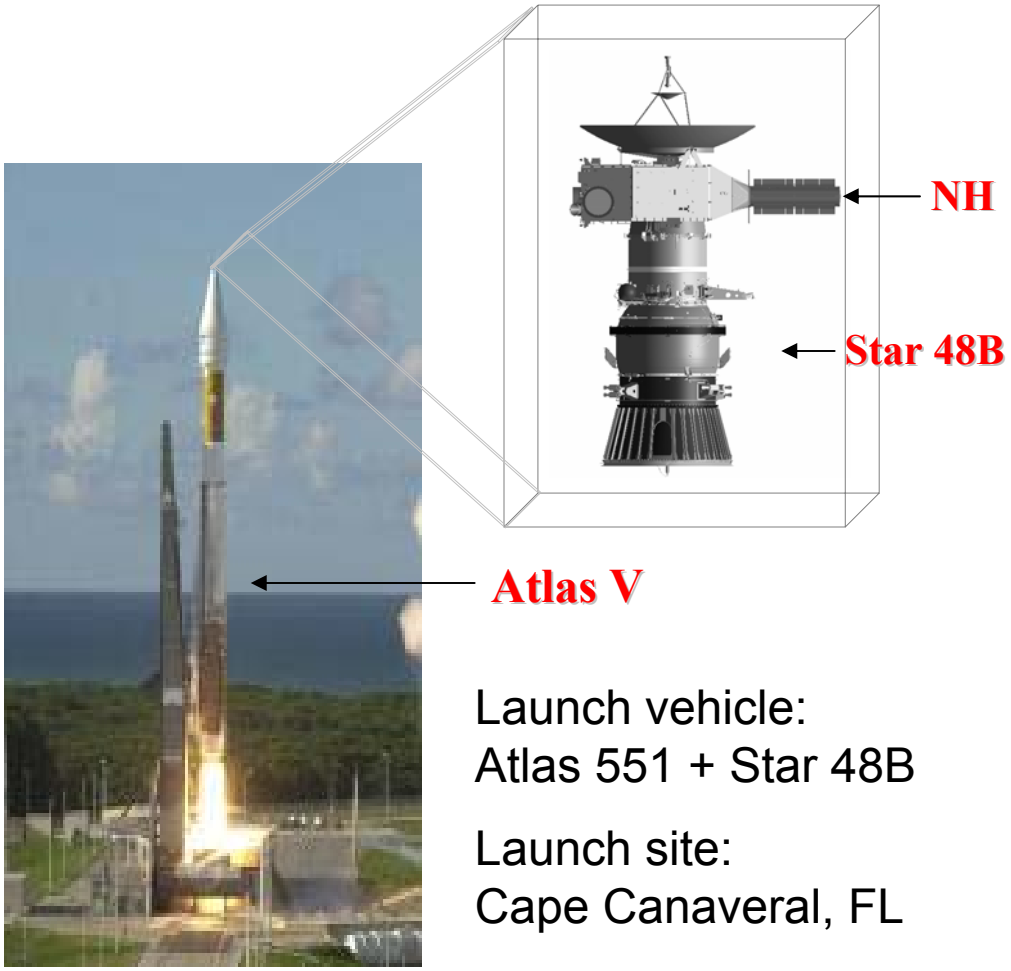
New Horizons Launch Overview

- 2006 Baseline
  - Launch Date:

    Jan. 11 – Feb. 14, 2006
  - Jupiter Flyby:

    Feb. – Mar., 2007
  - Pluto Arrival:

    2015-2020
- Launch Issues
  - Up to 2 hr launch window
  - Spinning, Non-coherent transceiver similar to CONTOUR



Launch vehicle:
Atlas 551 + Star 48B

Launch site:
Cape Canaveral, FL

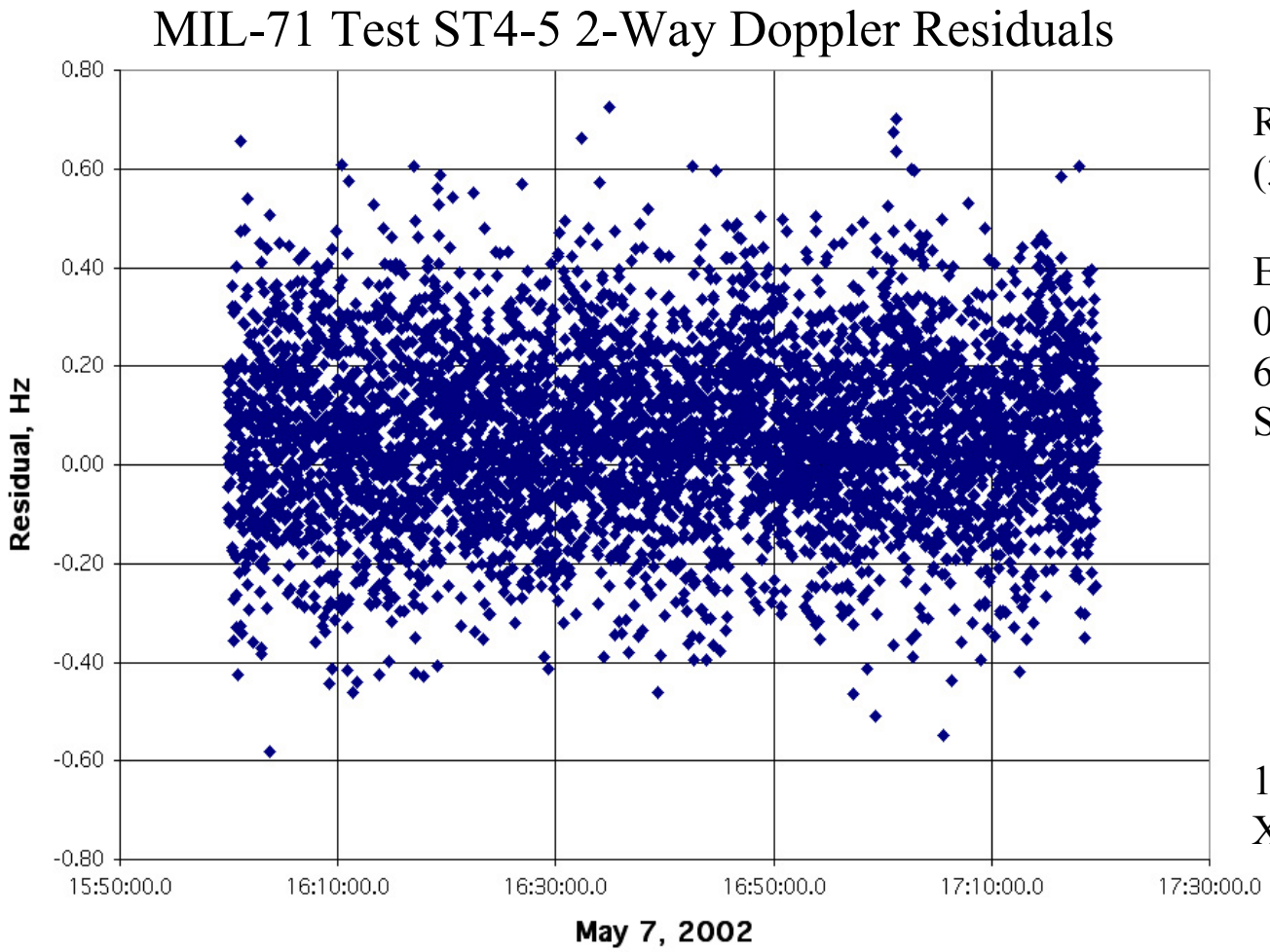
DSN Acquisition Assistance

- Requested Two ICVs (DSN's TRK-2-17 format) and OPMs, generated by Goddard
  - 1st, After Centaur MECO 1
  - 2nd, After Centaur MECO 2
- Deliver ICVs to:
  - DSN's NSS (but no MMNAV processing assumed)
- Deliver OPMs to :
  - Project MOC (Mission Design & Navigation)
- Delivery Method via NISN, fax, website within 10 minutes after MECOs

Pre-launch Transceiver Testing

- Differences from CONTOUR
  - JHU/APL will apply the transceiver calibration to Doppler tracking
  - New Horizons will use TRK 2-34 format for tracking data
- End-to-end tests planned for calibration function using MIL-71 ground-based, zero-Doppler data and telemetry (November, 2005)
- Parallel processing tests using MESSENGER tracking data will be performed to test compatibility with TRK 2-34 format

Transceiver MIL-71 Test from CONTOUR



RMS 0.185 Hz (3.4 mm/s)

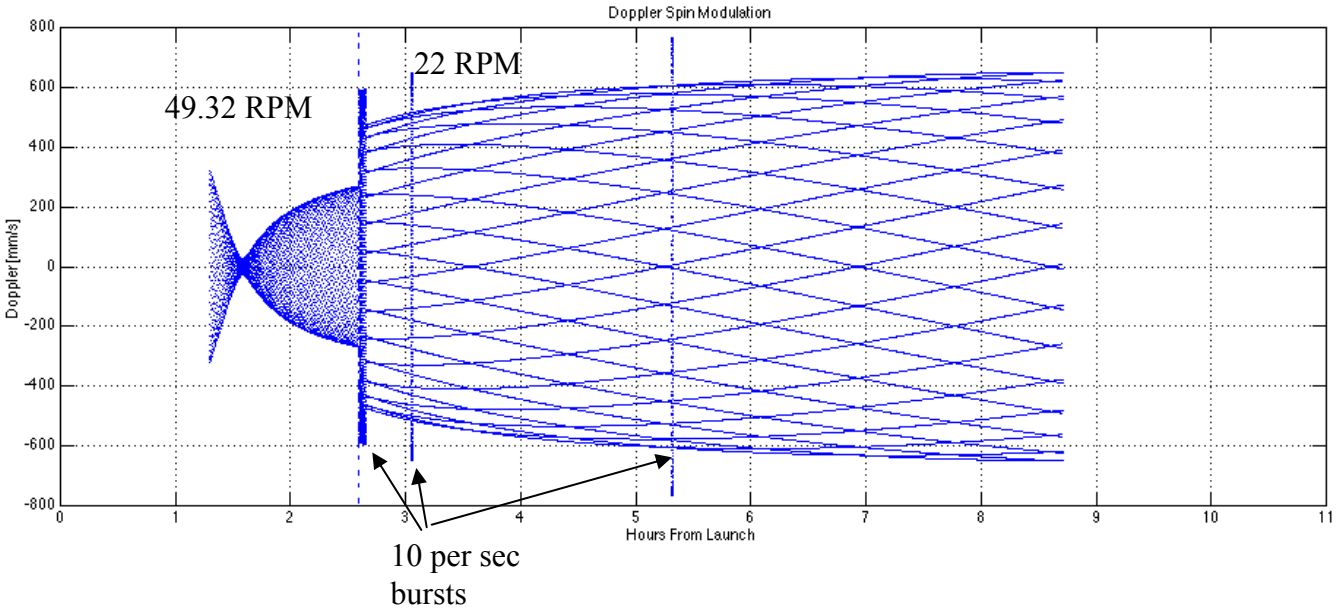
Equivalent to 0.4 mm/s @ 60-second Sample rate

1-second X-band data

New Horizons Spin

- New Horizons will separate from upper stage at about 80 rpm
  - At about 5.5 hours after launch, spin down to about 20 rpm
  - At about 2 days 20 hours after launch, spin down to 5 rpm
  - At about 15 days after launch, begin 3-axis mode for about 5 days
  - Most of cruise phase of mission is in “passive spin” mode at 5 rpm
- DSN Doppler tracking acquired during spin will be biased and may contain signatures due to spacecraft antenna wobble (nominally on the spin axis)

Doppler Rates and Spin Effects Predicted for CONTOUR

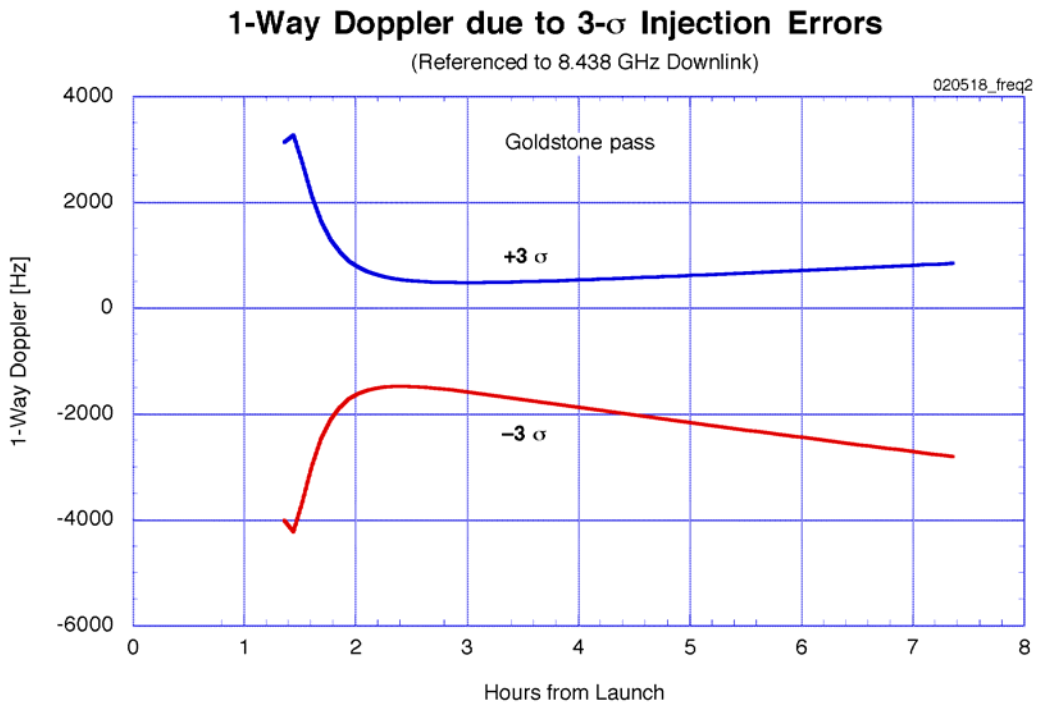


- 1 second compression with bursts at 10 per second

Issues with Transceiver ranging

- Non-coherent ranging requires ramping to remove uplink Doppler shift
- Turned-around uplink must match s/c transmitter frequency, or ranging fails during correlation of the higher (ambiguity) components:
- Allowable error ~900 Hz
  - Doppler uncertainty ~1500 Hz (3-sigma) for launch, < 1 Hz post launch
  - S/C transmitter uncertainty < 110 Hz (3-sigma) for launch, < 10 Hz post launch – CONTOUR values, need to update for NH
  - Max ramp error specification = 10 Hz
  - => No problem after 1st DSN predicts update post launch

Doppler Effect on Ranging - CONTOUR



- Ranging success unlikely before L+2 hours
- A sporting chance after L+2 hours
- Better chance if predicts are updated during pass

Summary

- New Horizons' radio metric tracking includes issues with transceiver Doppler, transceiver ranging, and Doppler sample rate
- New Horizons Navigation working together with DSN and APL to resolve all remaining issues.
- New Horizons Navigation will participate in remaining end-to-end tests, as well as internal ORTs with JHU/APL Mission Operations, and will be ready for launch on January 11, 2006
- New Horizons Navigation will participate in the Mission Events Readiness Review on December 5, 2005

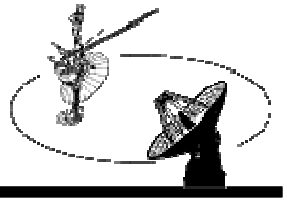
Interplanetary Network Directorate

Antenna Calibration Update

Joint Users Resource Allocation and Planning Meeting

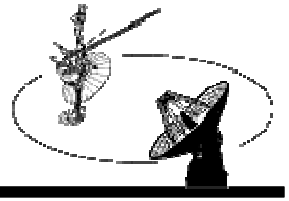
M. Wert

April 21, 2005



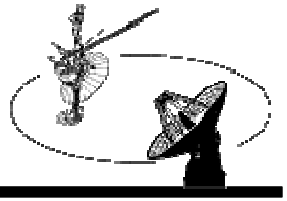
The "Ka-band" Challenge

- **Ka-band additional calibration requirements:**
  - **Ka-band (32 GHz) at DSS25, 26, 34, 55 (and 24 by 10/06, 54 by 8/07)**
    - **1/4 the beamwidth of X-band => 16 times the modeling complexity (4^2)**
    - **JPL (Rochblatt) determined Ka-band need for 4th-order pointing correction model (uses 118 terms)**
    - **X-band supports have been possible with 1st-order pointing model (using about 9 terms)**
    - **To accurately determine model, 4th-order will require 13 times the ANTCAL boresight data! (118 / 9)**



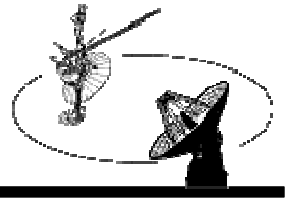
The "Ka-band" Challenge

- How do we get there without 13 to 16 times the ANTCAL requirement?
  - Insist on boresight data collection automation tool use
    - AMC provides automated boresight collection using DTT radiometer
    - In longer term, 920-funded release of "PET" tool – developed at MDSCC
  - Use pre-session observation scheduling optimization software
    - JPL has co-developed (with CDSCC) all-sky observation scheduling tool
  - ITT (under section 923 direction) is developing ANTCAL web site
    - Phase I – track ANTCAL block utilization and / or problems vs. scheduled time vs. long-range (ULP) requested time to facilitate problem identification and resolution
    - Phase II – track conscan-based pointing error trend indicators to monitor needs for extra effort and visualize progress



The "Ka-band" Challenge

- How much ANTCAL time is needed to "get there"
  - Plan to be submitted at next RARB (and being approached in mid-range beginning June) is to increase Ka-band capable antenna (25, 26, 34, 55) ANTCALs
    - from 8h per 6 weeks
    - to 8h per 3 weeks
  - Plan presented (Breidenthal / Rochblatt) to JURAP November 04
    - 8h per 2 weeks, with caveat
    - "We don't have enough experience yet to know what will work the best"
  - Plan being presented today includes monitoring so we'll know if changes are needed



The “Ka-band” Challenge

- The “benefit” of achieving Ka-band pointing calibration
  - CAS achieves radio-science goals
  - MRO achieves Ka-band telecommunication demonstration goals
  - Better blind-pointing accuracy for X-band users as well
  - Visibility into pointing error trends (via ANTCAL web site)

- Potential problems to achieving goal
  - ANTCAL schedules as “work category code” 2A5
  - Flight project use is 1A1
  - Mid-range and short-range conflicts “trump” ANTCAL when aperture is tightly scheduled
    - ANTCAL can be replanned if unscheduled blocks appear

JOINT USERS RESOURCE ALLOCATION PLANNING COMMITTEE

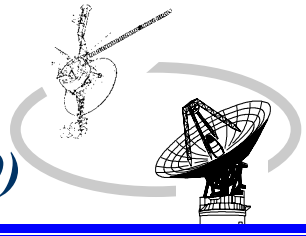
Resource Analysis Team

April 21, 2005

Joaquin Retana

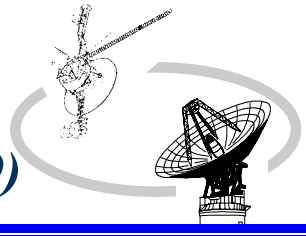
Mid-Range Scheduling Status

- **RESOURCE NEGOTIATION STATUS**
  - 2005 WEEKS 21 - 24 (THRU 06/19/2005) WERE RELEASED TO DSN SCHEDULING ON 04/05/2005.
  - 2005 WEEKS 25 - 28 (THRU 07/17/2005) ARE DUE TO BE RELEASED TO DSN SCHEDULING ON 04/29/2005.
  - 2005 WEEKS 29 - 42 (THRU 10/23/2005) ARE AWAITING CONFLICT RESOLUTION
- The Mid-range Scheduling process has negotiated schedules 25 weeks ahead of real-time. Currently, there are 9 weeks of conflict-free schedules. Conflict Resolution is required for the following sixteen (16) weeks: 29 through 42.



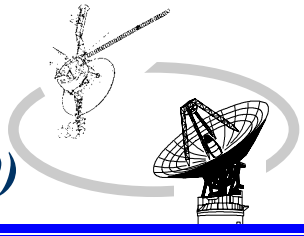
– Ongoing / Approved Projects –

Project	Acronym	Launch or Start	EOPM	EOEM
DSN Antenna Calibration	DSN	--	--	--
DSS Maintenance	DSS	--	--	--
DSN ZDD Calibration	DSN	11/01/04	--	--
European and Global VLBI Systems	EGS	--	--	--
Ground Based Radio Astronomy	GBRA	--	--	--
Reference Frame Calibration (Cat M&E and Clock Sync)	DSN	--	--	--
Space Geodesy	SGP	--	--	--
Voyager 2	VGR2	08/20/77	10/15/89	09/30/06
Voyager 1	VGR1	09/05/77	12/31/80	09/30/06
Goldstone Solar System Radar	GSSR	04/01/85	--	--
Ulysses	ULYS	10/06/90	09/11/95	03/30/08
Geotail	GTL	07/24/92	07/24/95	09/30/06
Wind	WIND	11/01/94	11/01/97	09/30/06
SOHO	SOHO	12/02/95	05/02/98	12/31/08
Polar	POLR	02/22/96	08/23/97	09/30/06
Gravity Probe B (non Spacecraft support)	GPB	06/01/96	08/31/05	TBD
Mars Global Surveyor	MGS	11/07/96	02/01/01	11/03/08



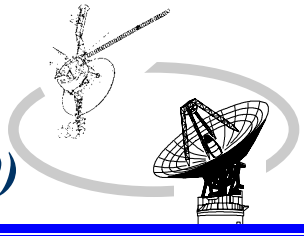
– Ongoing / Approved Projects –

Project	Acronym	Launch or Start	EOPM	EOEM
Advance Composition Explorer	ACE	08/25/97	02/01/01	09/30/10
Cassini	CAS	10/15/97	06/30/08	06/30/10
Stardust	SDU	02/07/99	02/15/06	- - -
Chandra X-ray Observatory	CHDR	07/23/99	07/24/09	07/24/14
Imager for Magnetopause-to-Aurora Global Exploration	IMAG	03/25/00	05/30/02	09/30/10
Cluster 2 - S/C #2 (Samba)	CLU2	07/16/00	02/15/03	12/31/09
Cluster 2 - S/C #3 (Rumba)	CLU3	07/16/00	02/15/03	12/31/09
Cluster 2 - S/C #1 (Salsa)	CLU1	08/09/00	02/15/03	12/31/09
Cluster 2 - S/C #4 (Tango)	CLU4	08/09/00	02/15/03	12/31/09
Mars Odyssey 2001	M01O	04/07/01	08/24/04	11/30/08
Wilkinson Microwave Anisotropy Probe	WMAP	06/30/01	10/01/03	09/30/09
Advanced Tracking and Observational Techniques (ATOT)	ATOT	02/01/02	12/31/08	- - -
International Gamma Ray Astrophysics Lab	INTG	10/17/02	12/18/04	12/31/08
Hayabusa (MUSES - C)	MUSC	05/09/03	06/10/07	- - -
Mars Express Orbiter	MEX	06/02/03	02/11/06	12/31/08
Spirit (Mars Exploration Rover - A)	MER2	06/10/03	04/06/04	09/30/08
Opportunity (Mars Exploration Rover - B)	MER1	07/07/03	04/27/04	09/30/08



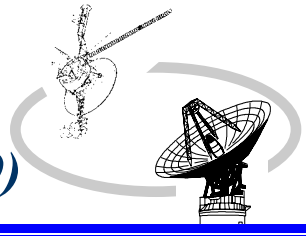
– Ongoing / Approved Projects –

Project	Acronym	Launch or Start	EOPM	EOEM
Spitzer Space Telescope (SIRTF)	STF	08/25/03	02/25/06	10/19/08
Rosetta	ROSE	02/26/04	12/31/15	- - -
Messenger	MSGR	08/03/04	03/19/12	- - -
Deep Impact	DIF	01/12/05	08/05/05	- - -
Mars Reconnaissance Orbiter	MRO	08/10/05	12/31/10	12/31/15
Venus Express	VEX	10/26/05	04/09/06	TBD
New Horizons	NHPC	01/11/06	04/17/16	TBD
Stereo Ahead	STA	02/11/06	05/16/08	05/17/11
Stereo Behind	STB	02/11/06	05/16/08	05/17/11
Space Technology 5	ST5	02/28/06	06/11/06	TBD
Dawn	DAWN	06/17/06	01/12/16	TBD
Lunar - A	LUNA	TBD	TBD	- - -
Kepler Mission	KLM	06/01/08	06/30/12	- - -

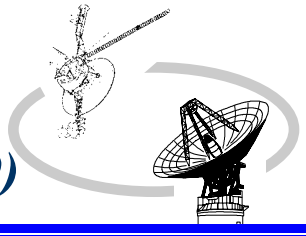


– Advanced / Planning Projects –

Project	Acronym	Launch or Start	EOPM	EOEM
SELENE	SELE	02/01/07	02/21/07	TBD
Phoenix	PHX	08/03/07	10/26/08	TBD
Lunar Reconnaissance Orbiter	LRO	11/15/08	TBD	TBD
Mars Telecommunications Orbiter 2009	MTO	09/22/09	08/19/20	TBD
Mars Science Laboratory 2009	MSL	10/25/09	03/04/12	TBD
Space Interferometry Mission	SIM	02/14/10	08/30/20	TBD
James Webb Space Telescope	JWST	08/01/11	07/31/16	TBD
Mars Placeholder 2011	M11L	10/30/11	09/10/14	TBD
Mars Placeholder 2013	M13O	11/28/13	08/21/16	TBD



- **ON-GOING SPECIAL STUDIES/ACTIVITIES**
  - Downtime Planning
  - MADB/TIGRAS Testing and Training
  - STEREO Ahead and Behind Study
  - Capacity Studies for 2008 – 2011
  - RARB Prep



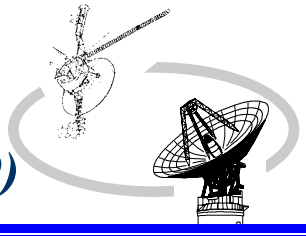
RESOURCE ALLOCATION REVIEW BOARD TIMELINE

for August 9, 2005

Review Period:

July, 2006 – December, 2008

	DATE	WORKDAYS	MILESTONES
–	05/03/05	-68 DAYS	DISTRIBUTE MISSION SET, MAJOR EVENTS AND USER LOADING PROFILES TO ALL PROJECTS/USERS FOR VERIFICATION
–	05/20/05	-55 DAYS	DEADLINE FOR PROJECTS/USERS RESPONSE TO MISSION SET, MAJOR EVENTS AND USERS LOADING PROFILES
–	05/31/05	-49 DAYS	START PRELIMINARY ANALYSES, CONTENTIONS AND RECOMMENDATIONS
–	07/14/05	-18 DAYS	NASA HEADQUARTERS SCIENCE REVIEW
–	07/15/05	-17 DAYS	PUBLISH RAPWEB PRELIMINARY EVENTS, CONTENTIONS AND RECOMMENDATIONS
–	08/01/05	-6 DAYS	COMPLETE REVIEW OF RAPWEB PUBLISHED CONTENTIONS AND RECOMMENDATIONS WITH PROJECT REPRESENTATIVES FOR ACCEPTANCE OR REJECTION
–	08/04/05	-3 DAYS	PUBLISH FINAL CONTENTIONS AND RECOMMENDATIONS ON THE RAPWEB
–	08/08/05	-1 DAY	DISTRIBUTE REVIEW BOARD MATERIAL TO RARB BOARD MEMBERS
–	08/09/05	XXXXX	RESOURCE ALLOCATION REVIEW



◆ SPECIAL STUDY SUMMARY

SELENE - Launch Opportunities — Completed: November 29, 2004

Purpose

SELENE Project requested RAPSO to perform a DSN Load Study to determine the best of four (4) launch opportunities. Proposed Launch Opportunities for SELENE: November 1, 2006, February 1, 2007, July 2, 2007, and October 1, 2007

Conclusion

The proposed SELENE launch on February 1, 2007 is recommended. The analysis indicates that the projected unsupportable time for a February launch range from 1 to 18 percent.

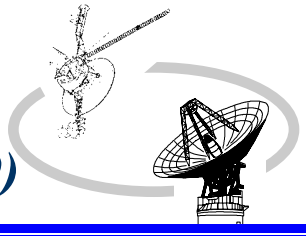
Rosetta - Newly Added Asteroid Flyby Supports — Completed: December 13, 2004

Purpose

Rosetta Project requested RAPSO to evaluate the DSN's support of the newly added Asteroid Flyby supports in 2008 and 2009 and to identify any other areas of contention during the prime and extended mission phases.

Conclusion

Analysis results indicated that the newly added support for Asteroid Flyby 1 is fully supportable. The Asteroid Flyby 2 in 2010 reveals some contention due to Mars Science Laboratory (2009), Mars Telecommunication Orbiter (2009) Mars Approach, MOI (continuous and near continuous activities).



◆ SPECIAL STUDY SUMMARY

DSS-27 Continuation in Service Report — Completed: January 5, 2005

Purpose

The DSN requested RAPSO to perform an assessment of the User Loading on the 34HEF, 34BWG1, and 26M Subnets to determine the impact on tracking requirements for 2005 through 2008 if DSS-27 is removed from service.

Conclusion

This study indicated that without DSS-27 the 26M Subnet percentage increase in unsupportable time for 2005 through 2008 is projected to range from 29% to 100%. The 34BWG1 Subnet percentage increase in unsupportable time for the same period range from 9% to 57%. The inclusion of the revised extended mission date requirements for Cluster 2, Polar, SOHO, Ulysses, and Wind will increase the unsupportable percentage.

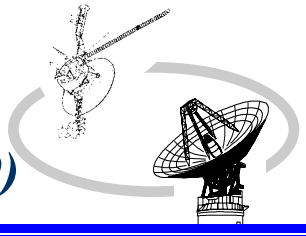
TDRSS Request for DSS-46 — Completed: February 3, 2005

Purpose

TDRSS requested RAPSO to determine if DSS-46 could provide 24-hour per day supports from March 2005 through March 2006

Conclusion

Based on current schedules created through Week 32/2005 and an approximation of future schedules, the DSN will be unable to provide TDRSS with the requested 24-hour support at DSS-46.



◆ SPECIAL STUDY SUMMARY

Mars Reconnaissance Orbiter Study — Completed: February 22, 2005

Purpose

MRO Project requested RAPSO to conduct an updated loading study to determine the impacts of MRO prime mission tracking requirement on the DSN

Conclusion

MRO should receive above 90% of the requested time during its prime mission phase. However, there are periods where MRO may have to negotiate with other mission especially when a Deep Space Station is down for maintenance and implementation.

Hayabusa (MUSES-C) Increased Supports 09/05 – 12/05 — Completed: March 14, 2005

Purpose

Hayabusa Project requested RAPSO evaluate the impact to the DSN resulting from an increase of twenty-eight (28) tracking passes from 12 September 2005 through 01 December 2005.

Conclusion

Based on current Mid-Range Resource Allocation schedules built through September 25, 2005 (Week 38) and an approximation of future schedules, the DSN will be able to accommodate the proposed increase in supports during September through December 2005.

◆ SPECIAL STUDY SUMMARY

DSN Downtime Proposals — Completed: March 7, 2005

Purpose

The DSN (Section 923) requested RAPSO to determine the best placement for the proposed 26 Meter S-Band Refurbishment and 34 Meter Near-Earth Ka-Band Implementation at DSS-34 and DSS-54 in 2007 and 2008

Conclusion

RAPSO Downtime Proposals Recommendations are as follows:

- DSS-16 – January 8, 2007 (Week 2) through April 1, 2007 (Week 13)
- DSS-54 – April 23, 2007 (Week 17) through July 15, 2007 (Week 28)
- DSS-34 – October 8, 2007 (Week 41) through December 2, 2007 (Week 48)
- DSS-46 – January 7, 2008 (Week 2) through March 30, 2008 (Week 13)
- DSS-66 – June 2, 2008 (Week 23) through August 24, 2008 (Week 34)

◆ SPECIAL STUDY SUMMARY

Impact to GSFC Missions If 26M Subnet is Decommissioned

Completed: **March 14, 2005**

Purpose

The DSN requested the impact to Projects assuming the 26 Meter Subnet will be decommissioned on September 30, 2008.

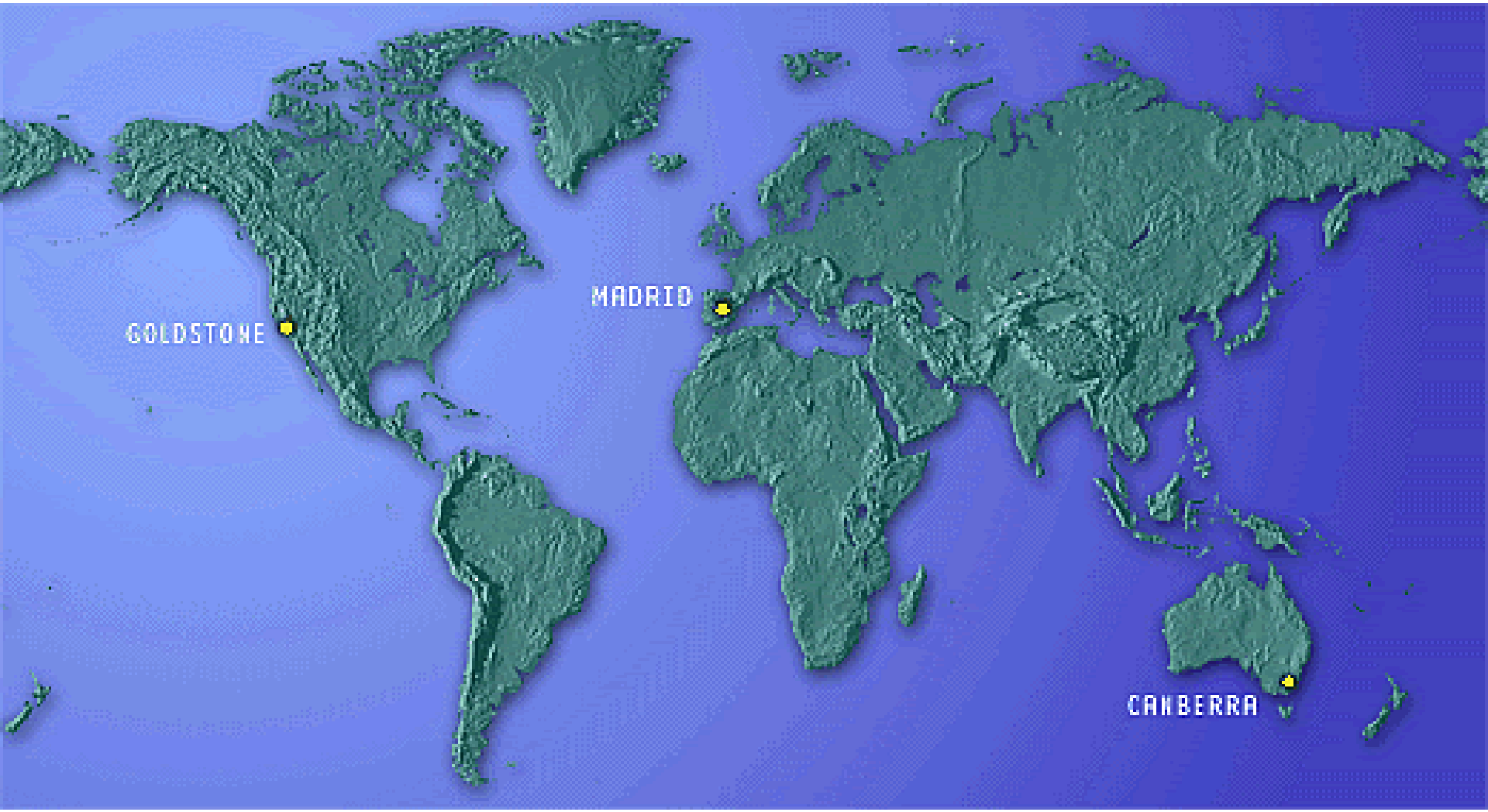
Conclusion

The conclusions indicate:

- Heavy impact in the October – December, 2008 time frame when it is predicted that more missions will require 26 Meter support.
- Overall the usage after 2008 on the 26 Meter Subnet is minimal causing little impact to the 34BWG1 Subnet.
- In many months from 2009 through 2012 the 34BWG1 is already oversubscribed and the 26M loading is of little or no impact to the 34BWG1 Subnet.

It is recommended that the 26 Meter Subnet not be decommissioned until January 2009

DSN Antenna Downtime Status and Forecast



http://rapweb.jpl.nasa.gov/planning

Antenna Downtime Status And Forecast Schedule

Major DSN Downtimes by Date

04/19/2005 18:02 UTC Time
Tuesday, April 19, 2005 11:01:20 AM Your Local Time

2005

Site	Description	Start	End	Duration (Days)	Weeks	Start DOY	End DOY
DSS 65	Antenna Controller Replacement	01/31/2005 00:00	08/31/2005 23:59	213	05 - 35	031	243
DSS 65	Relocation	01/31/2005 00:00	08/31/2005 23:59	213	05 - 35	031	243
DSS 34	X/X-Ka Band	02/15/2005 00:00	04/24/2005 23:59	69	07 - 16	046	114
DSS 25	USC Installation	05/16/2005 00:00	05/25/2005 23:59	10	20 - 21	136	145
DSS 24	USC Installation	05/30/2005 00:00	06/08/2005 23:59	10	22 - 23	150	159
DSS 43	Antenna Controller Replacement	07/18/2005 00:00	01/01/2006 23:59	168	29 - 52	199	001
DSS 43	NIB - USC Installation	07/18/2005 00:00	07/31/2005 23:59	14	29 - 30	199	212
DSS 43	Hydrostatic Bearing	07/18/2005 00:00	01/01/2006 23:59	168	29 - 52	199	001
DSS 15	USC Installation - NIB	09/12/2005 00:00	09/21/2005 23:59	10	37 - 38	255	264
DSS 15	Antenna Controller Replacement	09/12/2005 00:00	11/20/2005 23:59	69	37 - 46	255	323
DSS 55	USC Installation	09/12/2005 00:00	09/21/2005 23:59	10	37 - 38	255	264
DSS 54	USC Installation	09/26/2005 00:00	10/05/2005 23:59	10	39 - 40	269	278

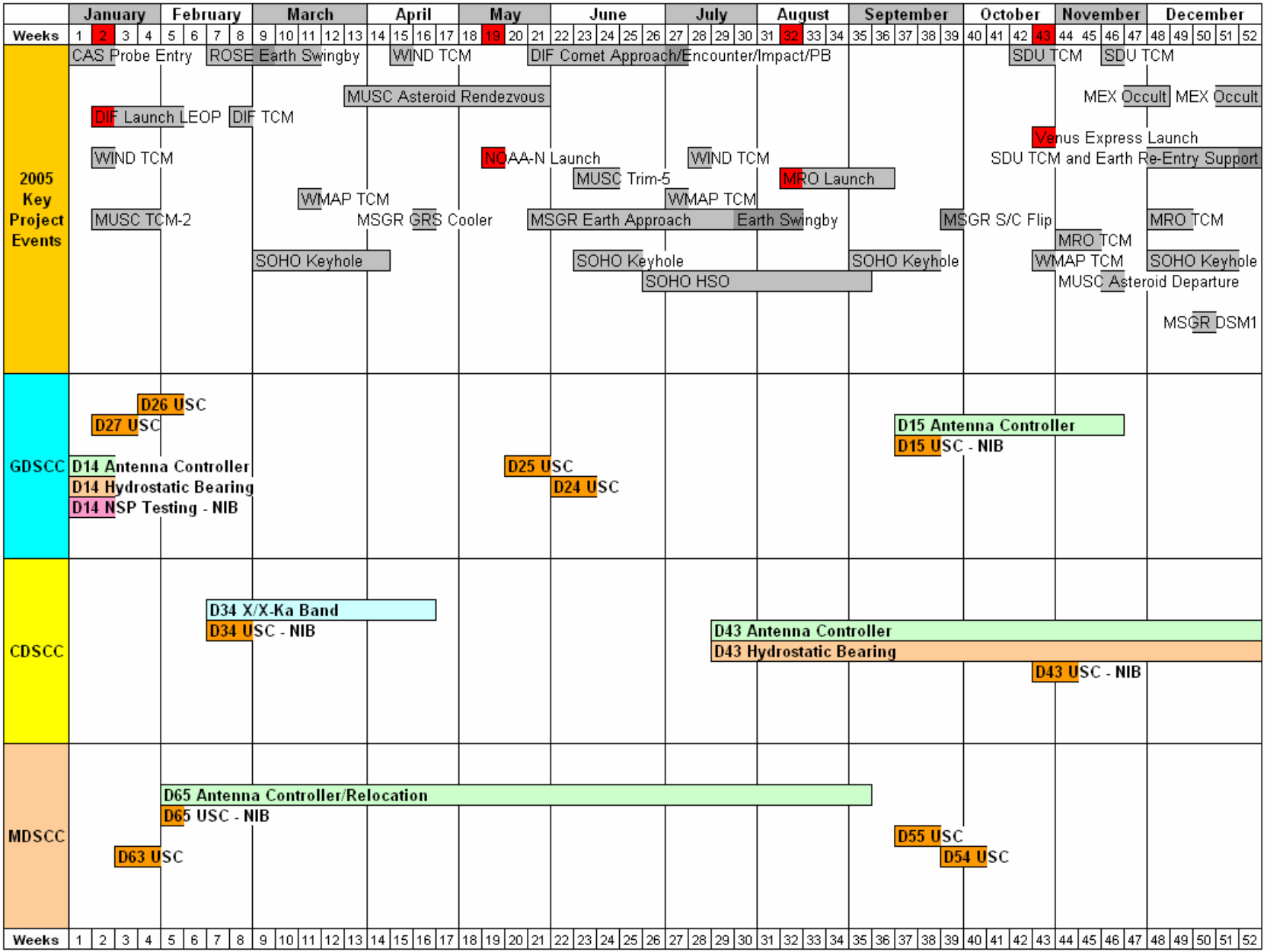
2006

Site	Description	Start	End	Duration (Days)	Weeks	Start DOY	End DOY
DSS 63	Antenna Controller Replacement	05/22/2006 00:00	09/03/2006 23:59	105	21 - 35	142	246
DSS 24	X/X-Ka Band	09/04/2006 00:00	10/22/2006 23:59	49	36 - 42	247	295
DSS 45	Antenna Controller Replacement	10/09/2006 00:00	12/10/2006 23:59	63	41 - 49	282	344

2007

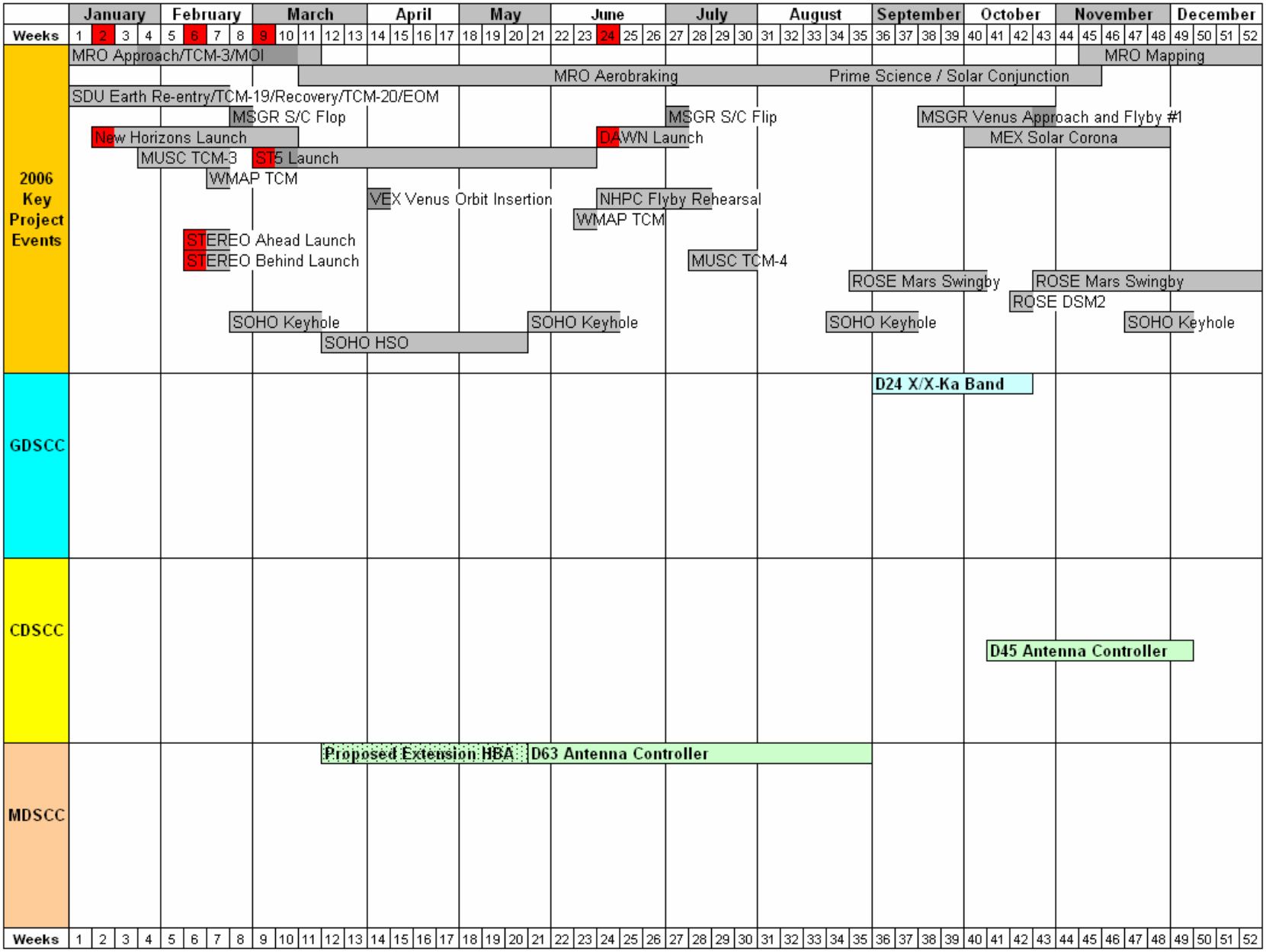
Site	Description	Start	End	Duration (Days)	Weeks	Start DOY	End DOY
DSS 54	X/X-Ka Band	06/04/2007 00:00	07/29/2007 23:59	56	23 - 30	155	210

Antenna Downtime Status And Forecast 2005



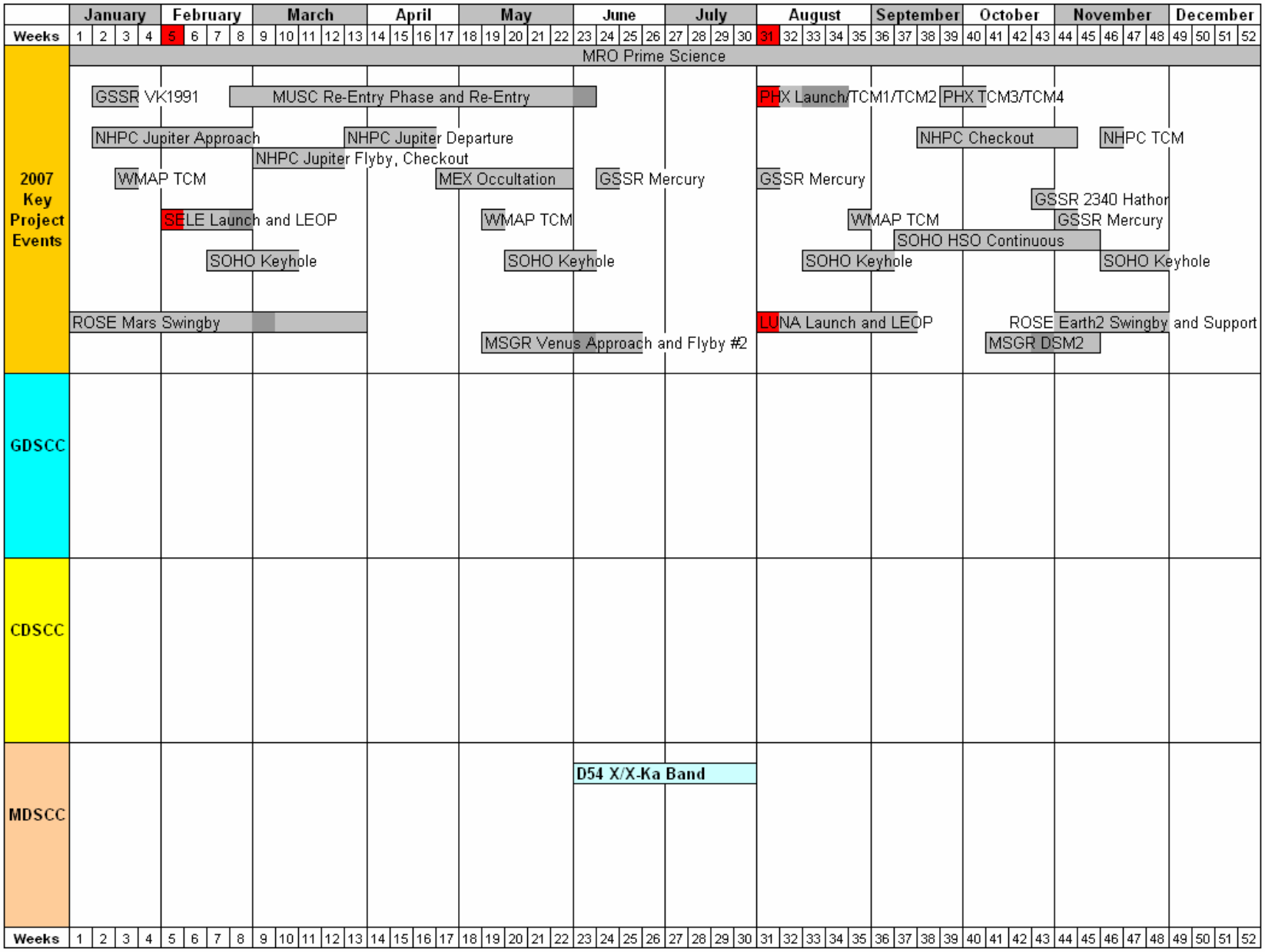
Revised: April 19, 2005

Antenna Downtime Status And Forecast 2006



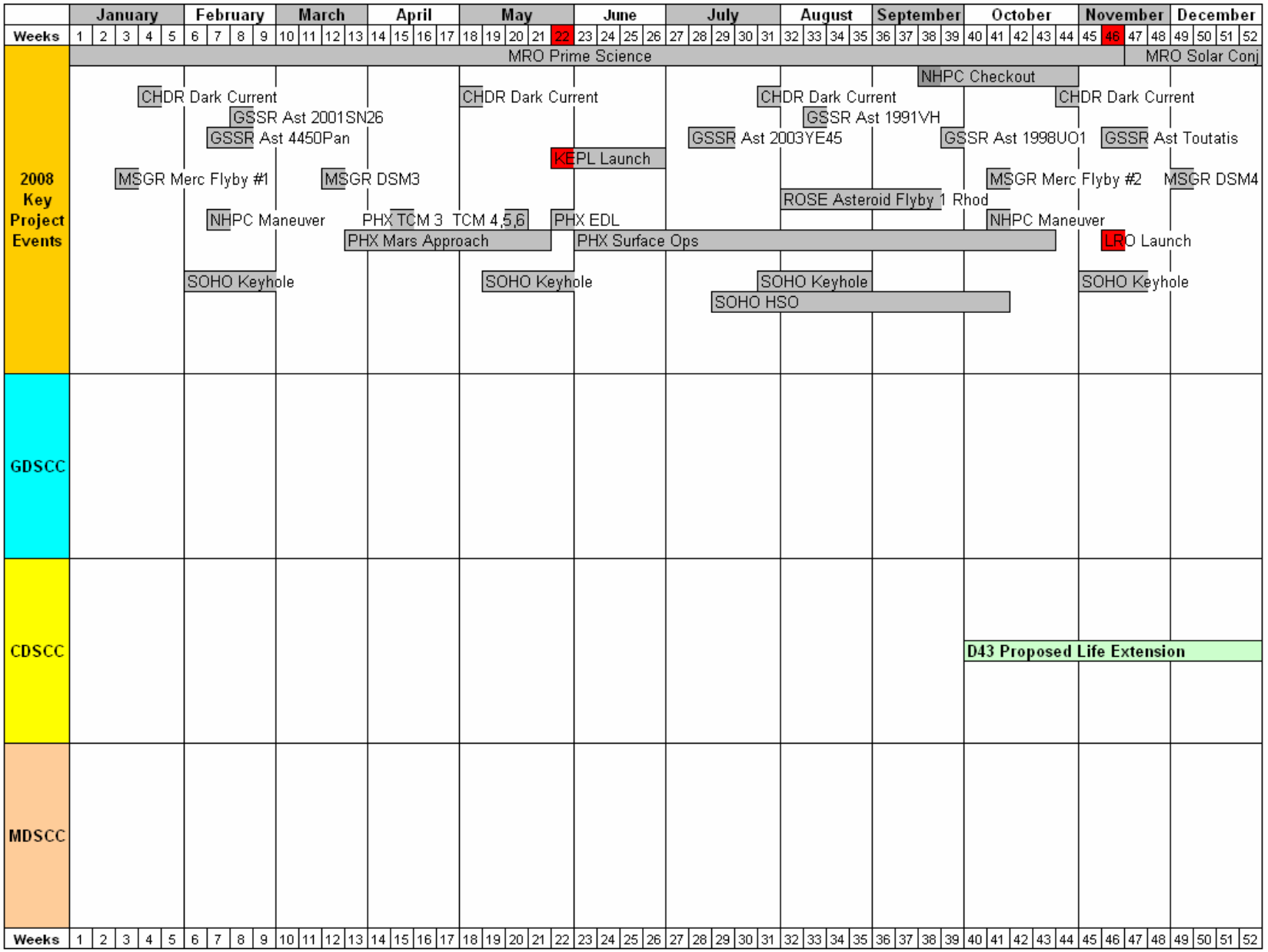
Revised: April 19, 2005

Antenna Downtime Status And Forecast 2007



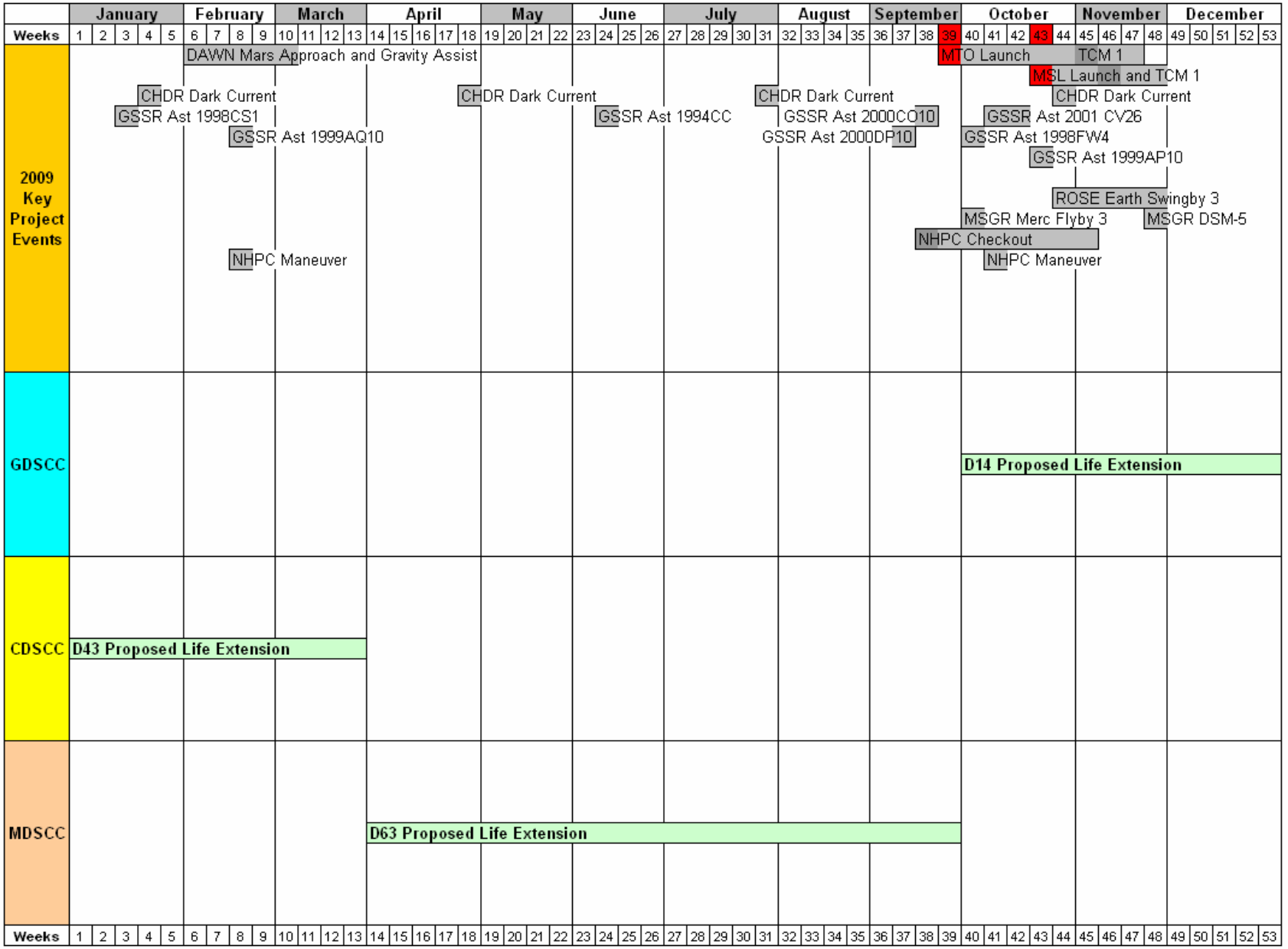
Revised: April 19, 2005

Antenna Downtime Status And Forecast 2008



Revised: April 19, 2005

Antenna Downtime Status And Forecast 2009



Revised: April 19, 2005

DSN Resource Implementation Planning Matrix by Complex

Complex	Station	Subnet	S-Band		X-Band		Ka-Band		NSP
			Down	Up	Down	Up	Down	Up	
10	DSS-14	70M	✔	✔	✔	✔	N/A	N/A	✔
10	DSS-15	34HEF	✔	N/A	✔	✔	TBD	N/A	✔
10	DSS-16	26M	✔	✔	N/A	N/A	N/A	N/A	N/A
10	DSS-24	34B1	✔	✔	✔	✔	10/23/06	N/A	✔
10	DSS-25	34B2	N/A	N/A	✔	✔	✔	✔	✔
10	DSS-26	34B2	N/A	N/A	✔	✔	✔	N/A	✔
10	DSS-27	34HSB	✔	✔	N/A	N/A	N/A	N/A	N/A
40	DSS-34	34B1	✔	✔	✔	✔	04/25/05	N/A	✔
40	DSS-43	70M	✔	✔	✔	✔	N/A	N/A	✔
40	DSS-45	34HEF	✔	N/A	✔	✔	TBD	N/A	✔
40	DSS-46	26M	✔	✔	N/A	N/A	N/A	N/A	N/A
60	DSS-54	34B1	✔	✔	✔	✔	08/01/07	N/A	✔
60	DSS-55	34B2	N/A	N/A	✔	✔	✔	N/A	✔
60	DSS-63	70M	✔	✔	✔	✔	N/A	N/A	✔
60	DSS-65	34HEF	✔	N/A	✔	✔	TBD	N/A	✔
60	DSS-66	26M	✔	✔	N/A	N/A	N/A	N/A	N/A

N/A = Capability Not Planned

xx/xx/xx = Capability Date Recently Changed

As of: 02/02/05

✔ ✔ ✔ = Capability Recently Exists

✔ = Capability Exists

DSN Resource Implementation Planning Matrix by Subnet

Complex	Station	Subnet	S-Band		X-Band		Ka-Band		NSP
			Down	Up	Down	Up	Down	Up	
10	DSS-16	26M	✔	✔	N/A	N/A	N/A	N/A	N/A
40	DSS-46	26M	✔	✔	N/A	N/A	N/A	N/A	N/A
60	DSS-66	26M	✔	✔	N/A	N/A	N/A	N/A	N/A
10	DSS-27	34HSB	✔	✔	N/A	N/A	N/A	N/A	N/A
10	DSS-24	34B1	✔	✔	✔	✔	10/23/06	N/A	✔
40	DSS-34	34B1	✔	✔	✔	✔	04/25/05	N/A	✔
60	DSS-54	34B1	✔	✔	✔	✔	08/01/07	N/A	✔
10	DSS-25	34B2	N/A	N/A	✔	✔	✔	✔	✔
10	DSS-26	34B2	N/A	N/A	✔	✔	✔	N/A	✔
60	DSS-55	34B2	N/A	N/A	✔	✔	✔	N/A	✔
10	DSS-15	34HEF	✔	N/A	✔	✔	TBD	N/A	✔
40	DSS-45	34HEF	✔	N/A	✔	✔	TBD	N/A	✔
60	DSS-65	34HEF	✔	N/A	✔	✔	TBD	N/A	✔
10	DSS-14	70M	✔	✔	✔	✔	N/A	N/A	✔
40	DSS-43	70M	✔	✔	✔	✔	N/A	N/A	✔
60	DSS-63	70M	✔	✔	✔	✔	N/A	N/A	✔

N/A = Capability Not Planned

xx/xx/xx = Capability Date Recently Changed

As of: 02/02/05

✔ ✔ ✔ = Capability Recently Exists

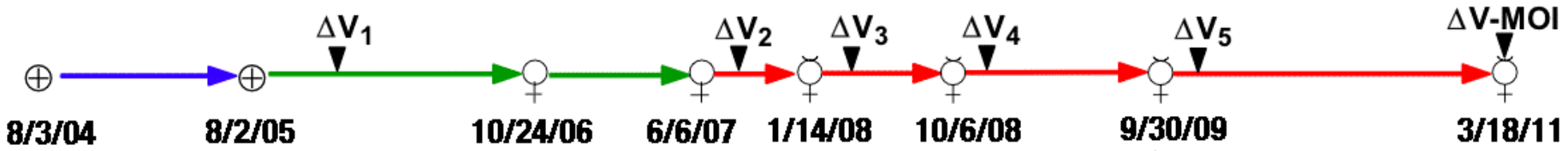
✔ = Capability Exists

MESSENGER Navigation

Approaching the Earth Flyby

MESSENGER

Key Dates



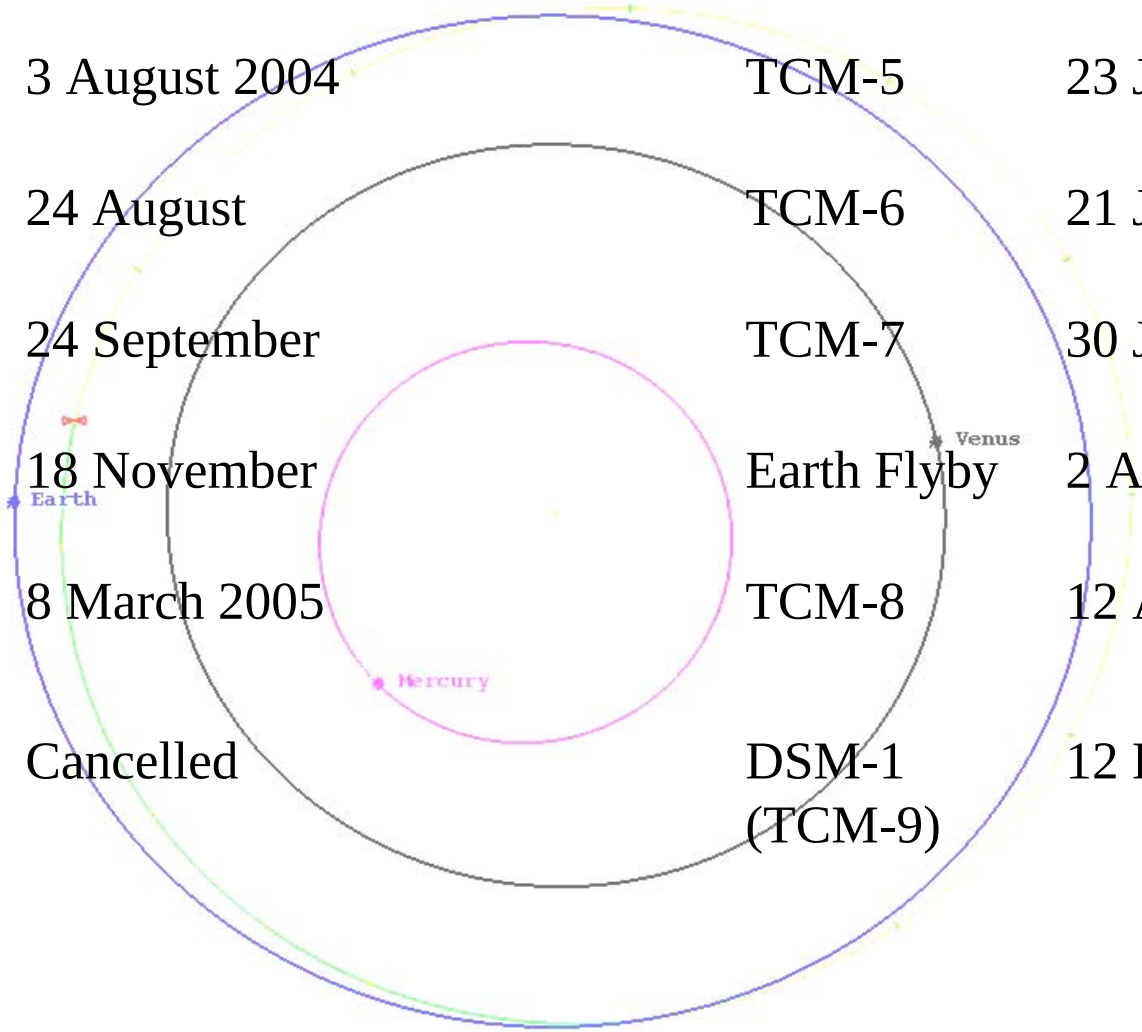
⊕ Earth ☿ Mercury

♀ Venus MOI Mercury Orbit Insertion

MESSENGER

Key Dates — Launch to Earth Flyby

Launch	3 August 2004	TCM-5	23 June
TCM-1	24 August	TCM-6	21 July
TCM-2	24 September	TCM-7	30 July
TCM-3	18 November	Earth Flyby	2 August
Flip	8 March 2005	TCM-8	12 August
TCM-4	Cancelled	DSM-1 (TCM-9)	12 December



MESSENGER

Flyby Movie – Earth-fixed

QuickTime™ and a
Video decompressor
are needed to see this picture.

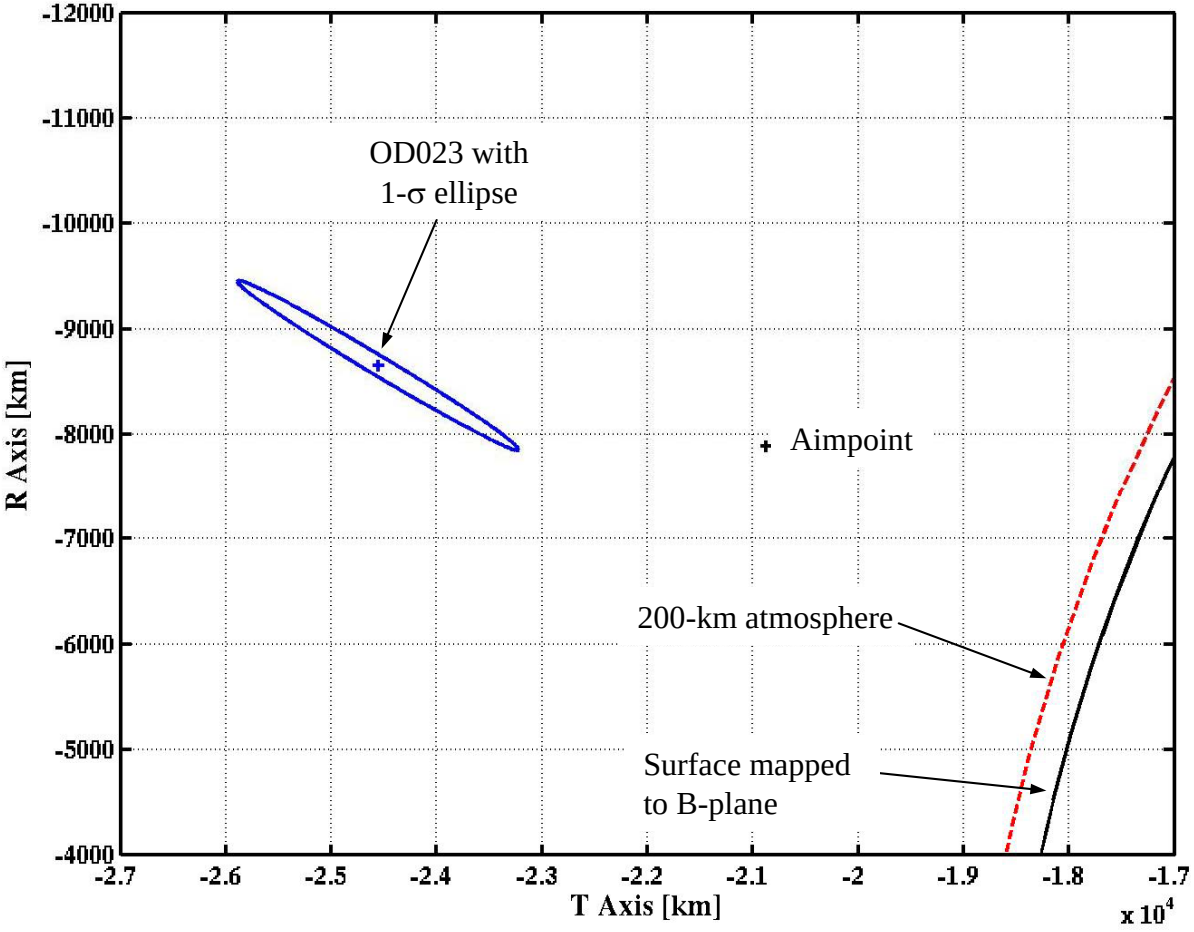
MESSENGER

Flyby Movie – S/C-fixed

QuickTime™ and a
Video decompressor
are needed to see this picture.

MESSENGER

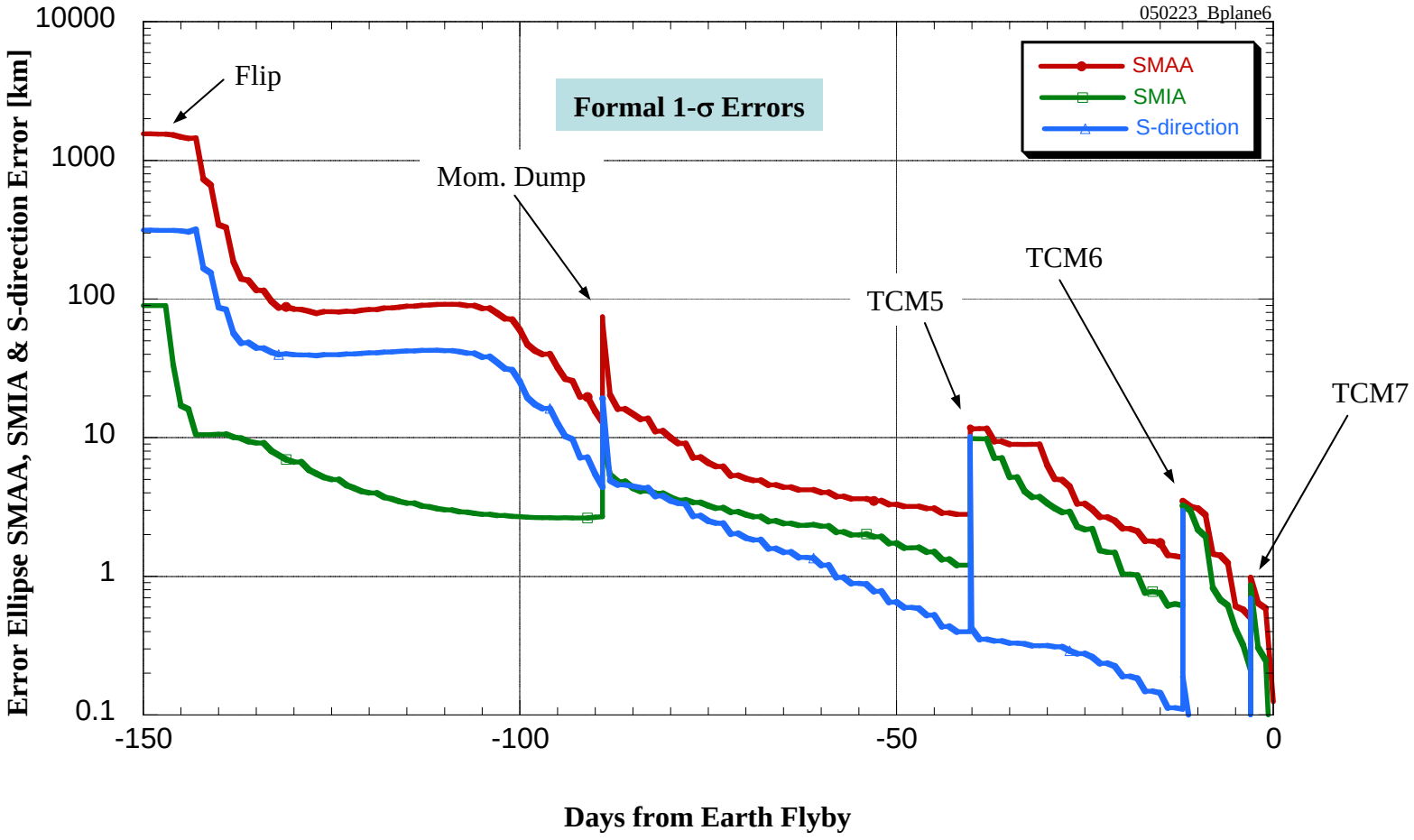
Recent OD Solution (OD023)



MESSENGER

Knowledge versus Time-to-go

B-plane Errors at Earth Flyby (1-σ)



MESSENGER

Flip

- "Flip" on 8 March 2004 turned sunshade to sun for 1st time
- Flyby uncertainties decreased rapidly as we calibrated the new sun-pointing surfaces
- "Flop" (sunshade away from sun) in late June 2005 is being considered because of thermal & power issues as spacecraft moves away from sun
  - Will change flyby slightly (~12 km)
  - Easily accommodated by Nav

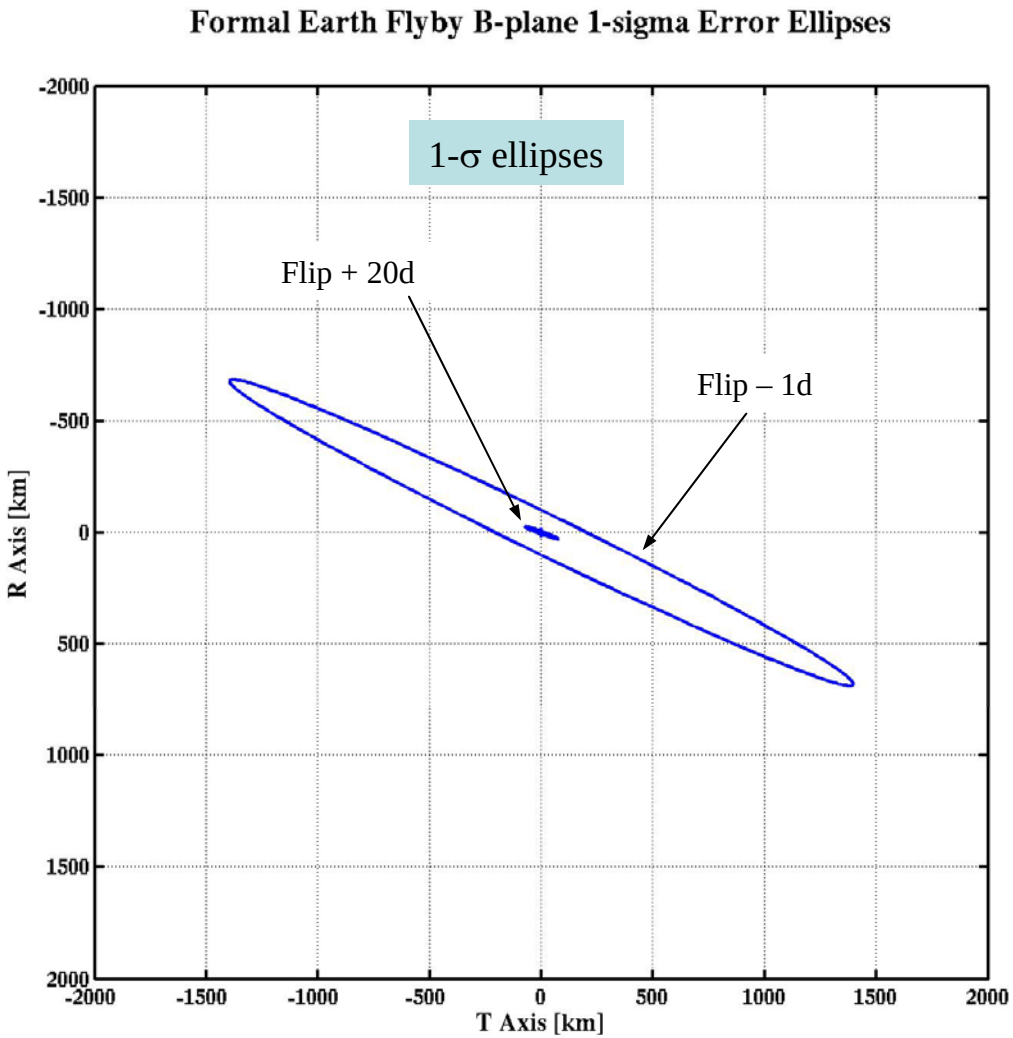
MESSENGER

Flip Movie

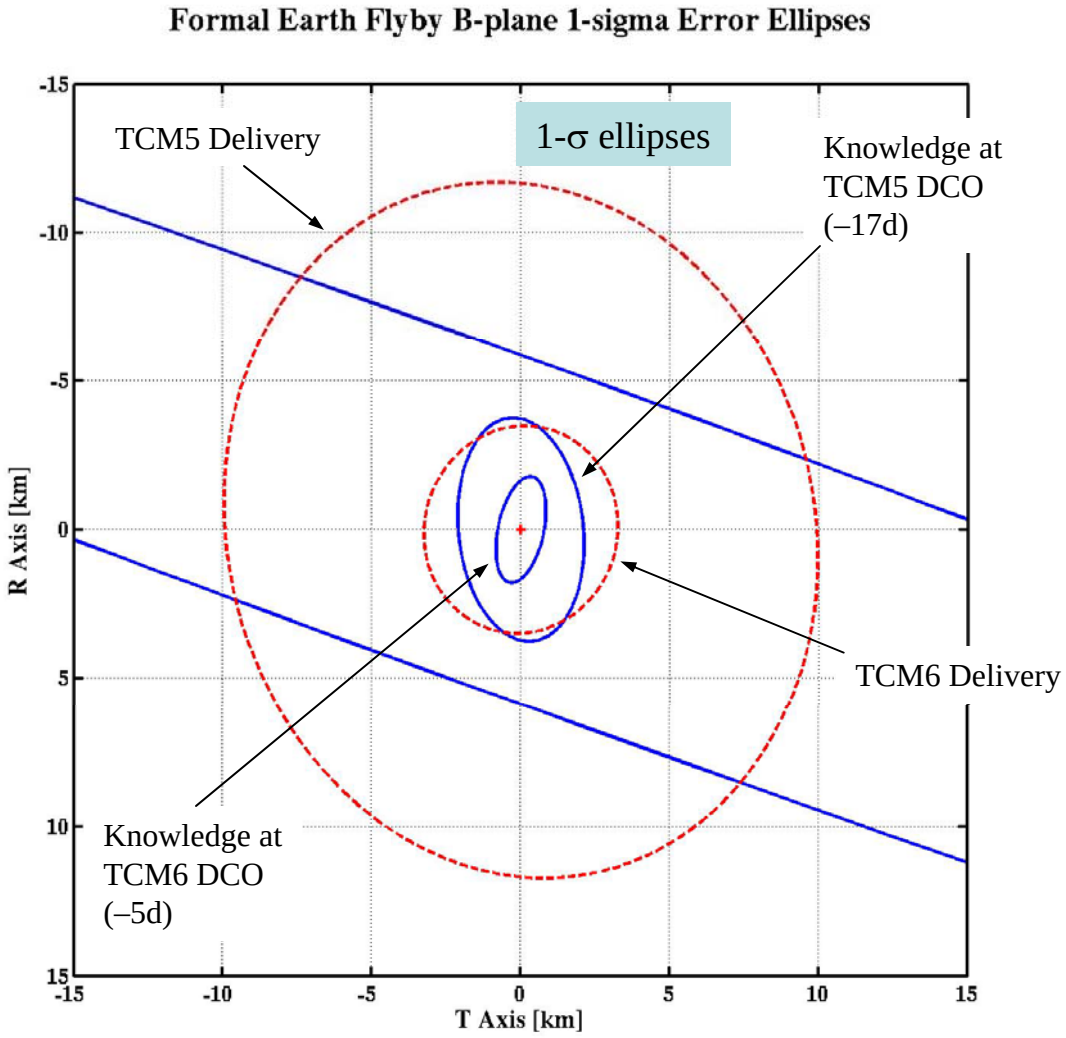
QuickTime™ and a
Video decompressor
are needed to see this picture.

MESSENGER

Pre- versus Post-Flip

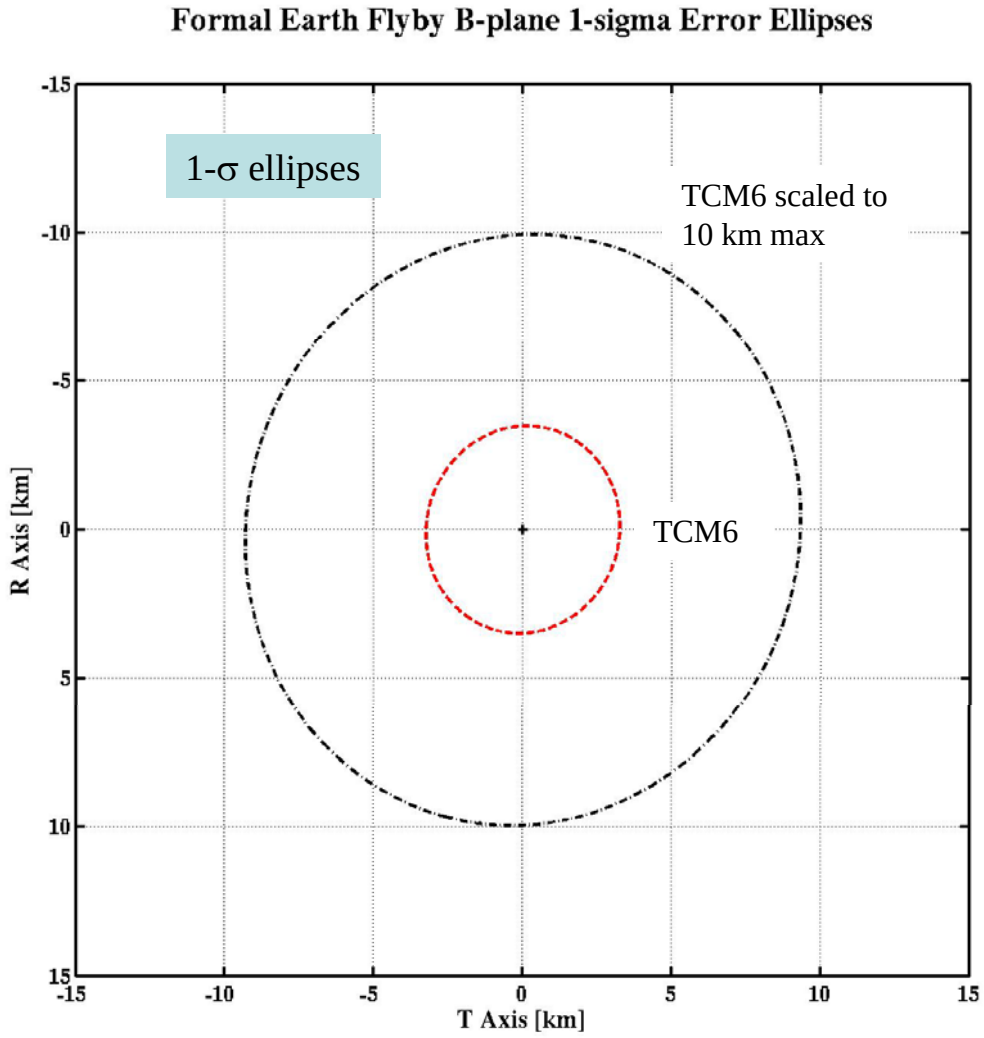


TCMs 5 and 6


Formal Earth Flyby B-plane 1-sigma Error Ellipses
TCM5 Delivery
1-σ ellipses
Knowledge at
TCM5 DCO
(–17d)
TCM6 Delivery
Knowledge at
TCM6 DCO
(–5d)
R Axis [km]
T Axis [km]
-15
-10
-5
0
5
10
15

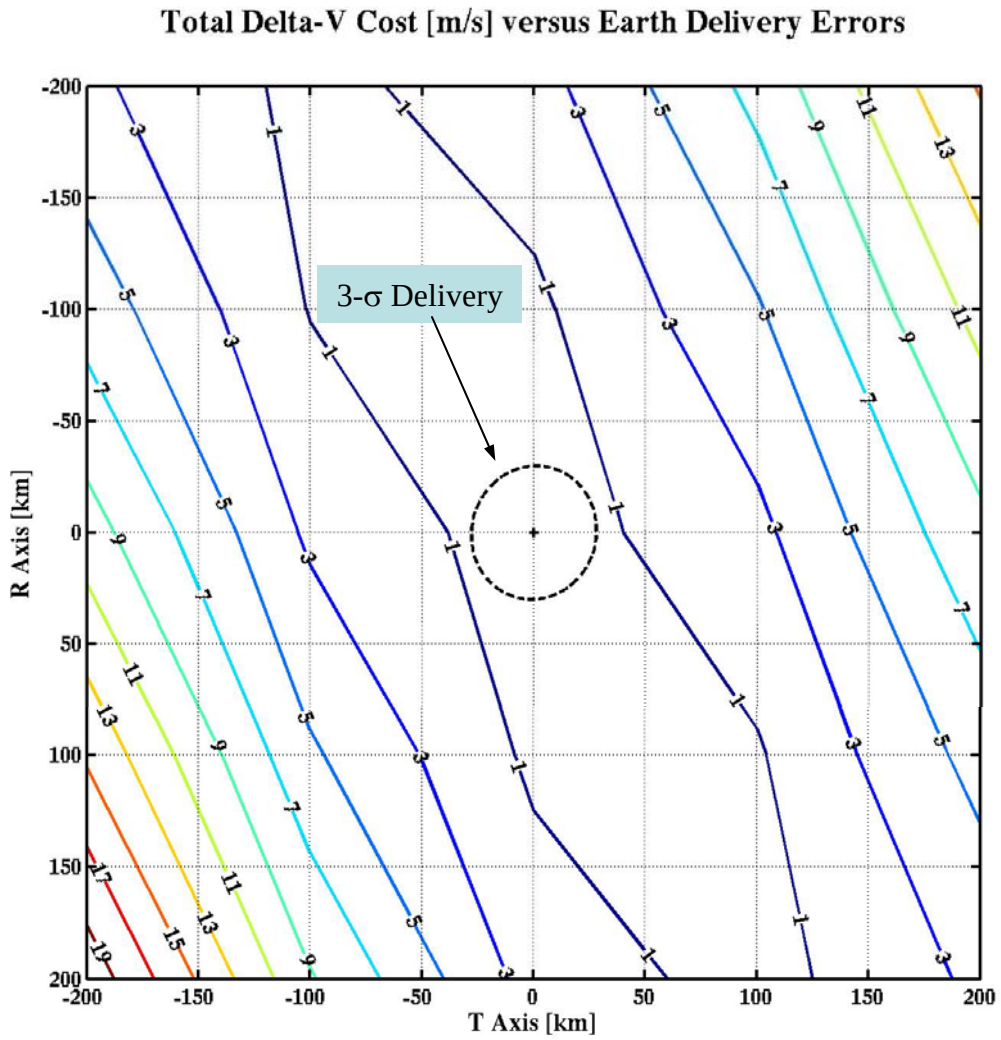
MESSENGER

More Realistic Final Delivery

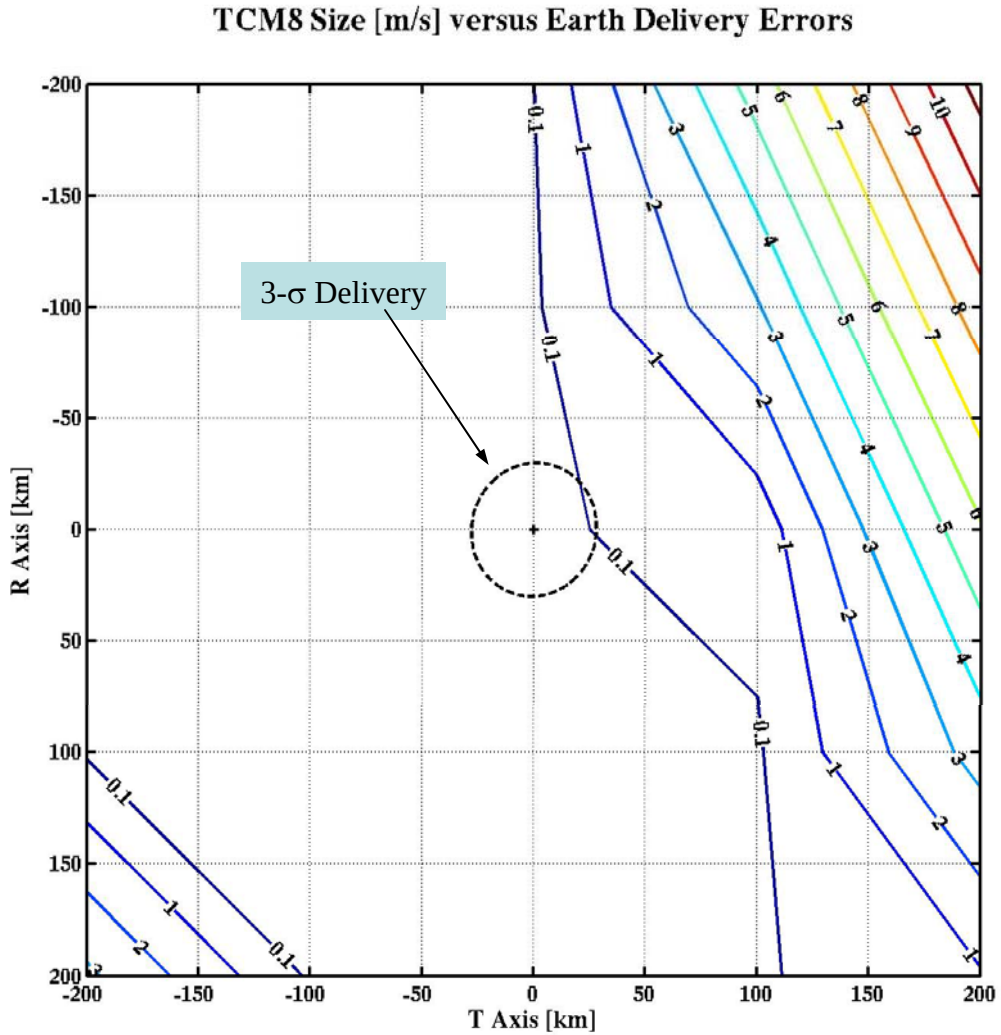


MESSENGER

Optimized Mission Cost Contours

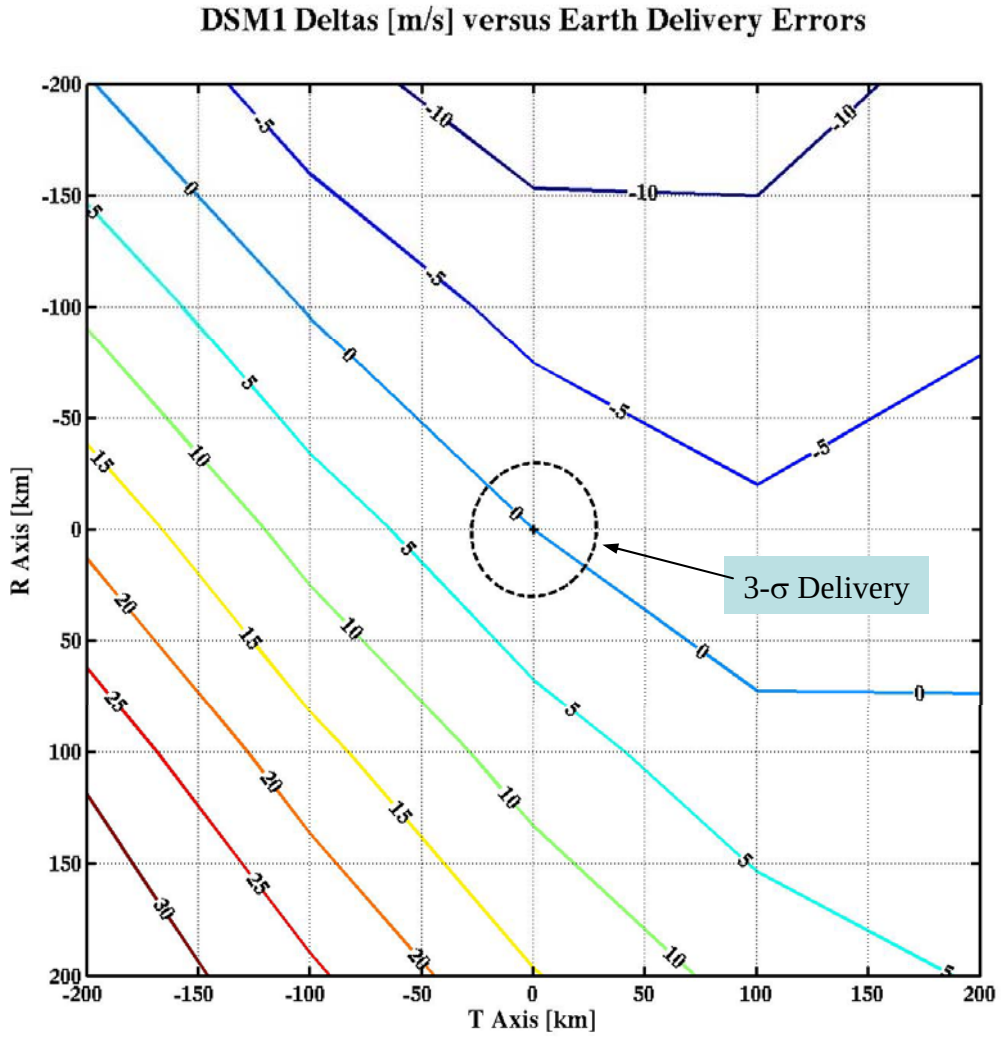


Flyby Cleanup Maneuver (TCM8) Cost



MESSENGER

Effect on DSM1 Size



MESSENGER

Summary

- Current Nav prediction is about 3,500 km from Earth flyby aimpoint
  - TCM-5 (23 June) is required & will be 1 – 1.5 m/s
- TCM-5/TCM-6 expected to deliver a 30 km error (3-σ) to aimpoint
  - TCM-7 is regarded as contingency only
- Re-optimization after flyby should result in total mission cost < 1 m/s
  - TCM-8 (flyby cleanup) is unlikely
- Overall: A benign Earth flyby is expected from the Navigation standpoint

ulysses

JOINT USERS RESOURCE ALLOCATION PLANNING COMMITTEE

http://ulysses.jpl.nasa.gov/

B. Brymer

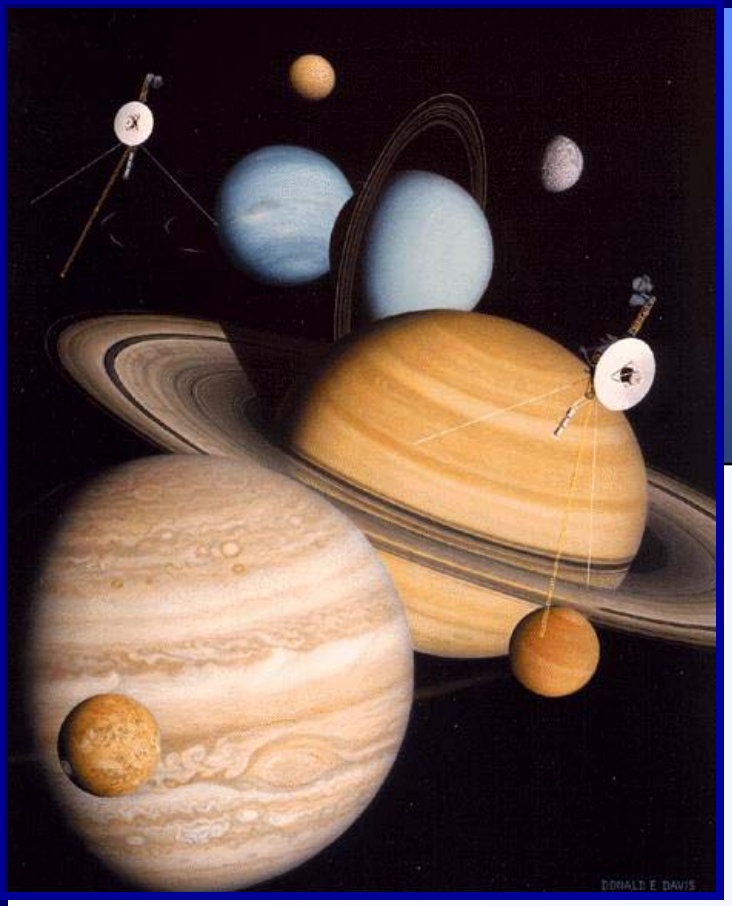
April 21, 2005

NASA Jet Propulsion Laboratory

ULYSSES

JOINT USERS RESOURCE ALLOCATION PLANNING COMMITTEE

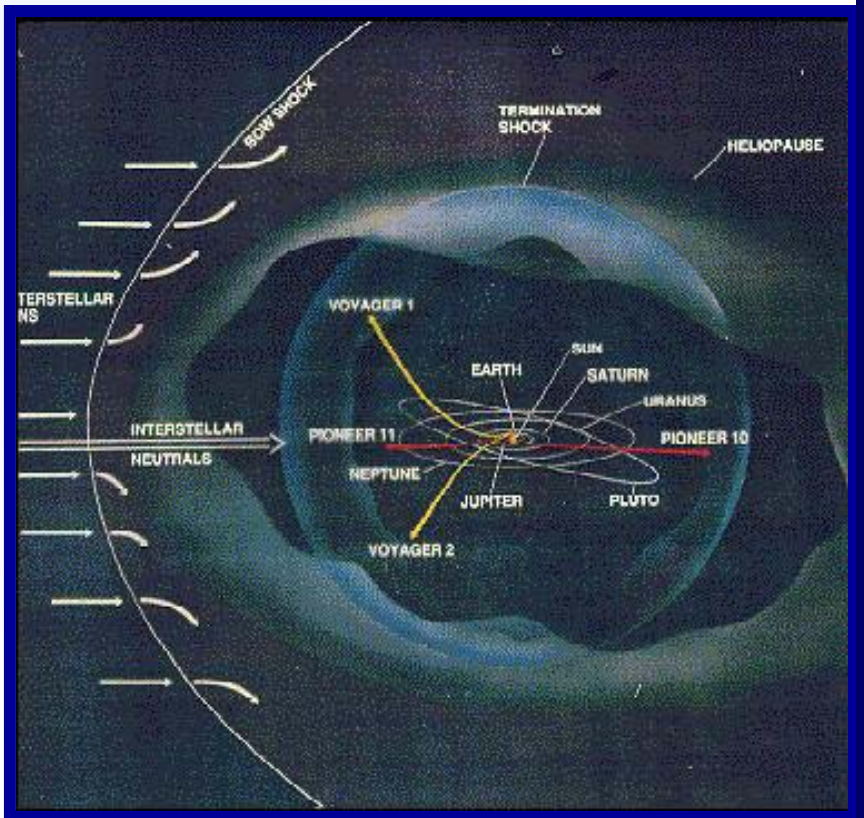
- ROUTINE SPACECRAFT OPERATIONS CONTINUE
- SPACECRAFT POWER AND THERMAL RECONFIGURATIONS AND INSTRUMENT CALIBRATIONS ARE PERFORMED AS REQUIRED
- SPACECRAFT EARTH-POINTING MANEUVERS ARE BEING PERFORMED ON A ROUTINE BASIS



VOYAGER

FLIGHT OPERATIONS

JOINT USERS RESOURCE ALLOCATION PLANNING COMMITTEE



Jefferson Hall
APRIL 21, 2005
NASA Jet Propulsion Laboratory

http://voyager.jpl.nasa.gov

VOYAGER

FLIGHT OPERATIONS

JPL

JPL NASA Jupiter Saturn Uranus Neptune and Beyond... VOYAGER I & II

FFLIGHT SYSTEM STATUS

VOYAGER 1

* HELIOCENTRIC DISTANCE – 95.3 AU, RTLT – 26h14m22s
* SPACECRAFT REMAINS HEALTHY
* MAJOR ACTIVITY: PMPCAL [FIELDS AND PARTICLES CALIBRATIONS], DTR PLAYBACK, ASCAL, MAGROL, DTR PLAYBACK

VOYAGER 2

* HELIOCENTRIC DISTANCE – 76.3 AU, RTLT – 21h5m14s
* SPACECRAFT REMAINS HEALTHY
* MAJOR ACTIVITY: PMPCAL [FIELDS AND PARTICLES CALIBRATIONS], ASCAL, MAGROL, DTR PLAYBACK

VOYAGER

FLIGHT OPERATIONS

JPL

GROUND SYSTEM STATUS

(November 13, 2004 thru April 21, 2005)

- DSN - OVERALL SUPPORT – GOOD
  - NUMEROUS SMALL OUTAGES AT DSS-14, DSS-15, DSS-25, 54, AND DSS-63 FOR VOYAGER 1 DUE TO WEATHER AND HARDWARE PROBLEMS
  - THREE SMALL OUTAGES AT DSS-45 FOR VOYAGER 2 DUE TO WEATHER PROBLEMS
- STOP SCHEDULING DSS-43 RESOURCES FOR DTR PLAYBACKS ON VOYAGER 2

VOYAGER

FLIGHT OPERATIONS

JPL

TOTAL SUPPORT TIME, OUTAGE TIME, % OF OUTAGE TIME

S/C	SCHED. SUPPORT	ACTUAL SUPPORT	70M TIME	SIGNIFICANT OUTAGE TIME	% OF OUTAGE TIME
31	1538.6	1539.8	332.3	32.0(5.7)	2.5%
32	995.4	1007.9	421.2	6.5(3.6)	1.0%

VOYAGER HOMEPAGE - http://voyager.jpl.nasa.gov